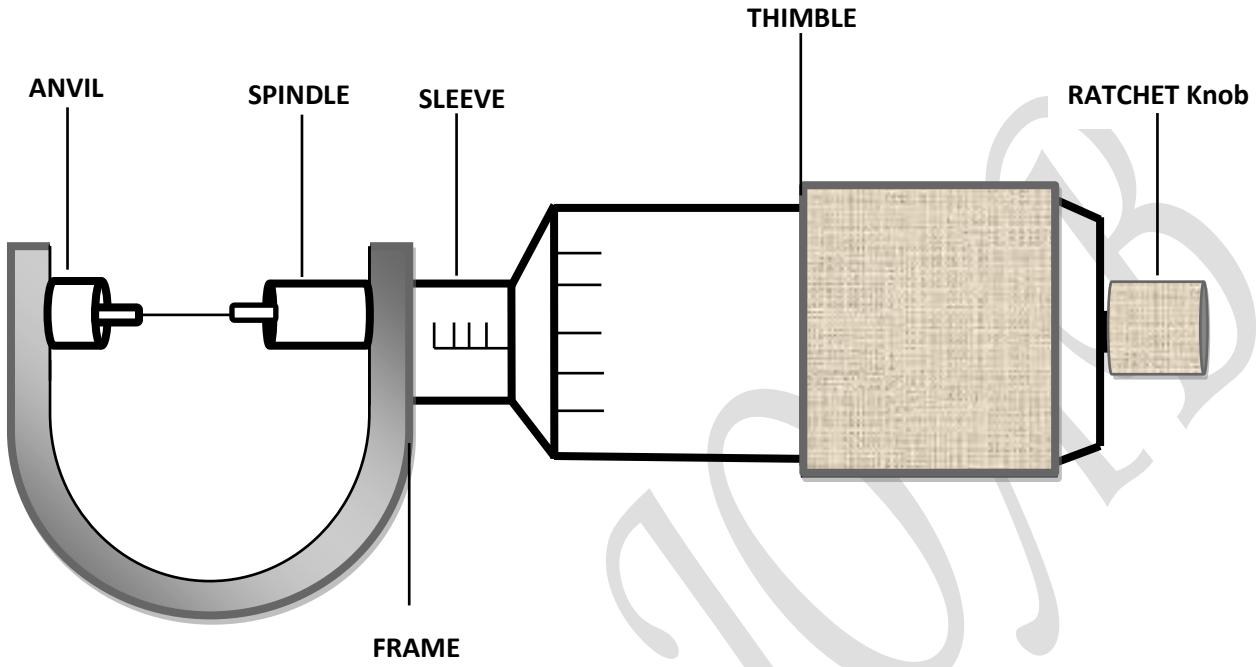
TUPASEKO PHYSICS

REVISION GUIDE



PUPIL'S NAME.....

MOBILE No:.....

GRADE:.....

SCHOOOL:.....

CONTENTS

- PHYSICAL MEASUREMENTS
- MASS WEIGHT & DENSITY
- KINEMATIC (SPEED,VELOCITY AND ACCELERATION)
- DYNAMICS (FORCE & MOTION)
- WORK ENERGY & POWER
- MOMENT AND STABILITY
- GAS LAWS
- PRESSURE
- BROWNIAN MOTION
- WAVE MOTION
- CURRENT ELECTRICITY
- STATIC ELECTRICITY
- MAGNETISM
- ELECTROMAGNETIC INDUCTION
- MUTUAL INDUCTION (TRANSFORMER)
- CATHODE RAY OSCILLASCOPE (CRO)
- ELECTRONICS
- RADIOACTIVITY AND NUCLEAR ATOM

COMPILED BY: MR. MUSONDA J [MJ]

CONTACT:+26 0965-171 750 /+26 0954197045

2017 PRODUCTION

PHYSICS SERIES

BASED ON THE NEW SYLLABUS

PHYSICAL MEASUREMENTS

1. Write down the most appropriate instrument to use in the measuring of the following .
   (a) Thickness of a mobile telephone scratch card
   (b) Diameter of a thin metal rod.
   (c) Thickness of your hard cover book.
   (d) Diameter of a thin wire
   (e) The width of the football pitch .
   (f) The thickness of your hair.

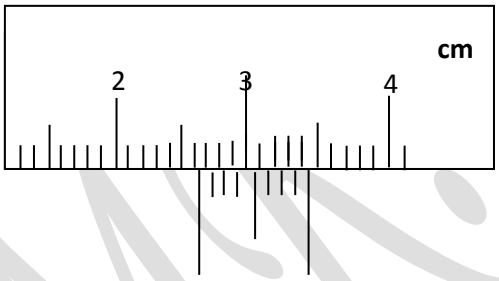
[TOTAL: 6 MARKS]

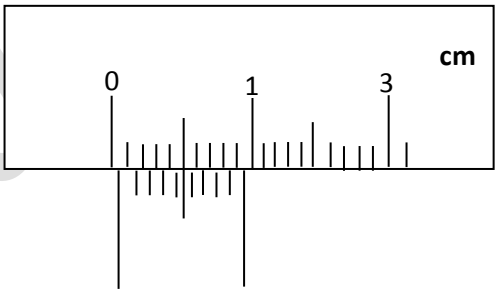
2. (a) Define a
   (i) Vector quantity
   (ii) Scalar quantity
   (b) Give four examples of a
   (i) Vector quantity
   (ii) Scalar quantity
   (c) Differentiate a vector quantity from a scalar quantity. [9]

[TOTAL: 9MARKS]

3. (a) Of what accuracy is the vernier calliper in mm and in cm?
   (b) What is the function of the following parts of a vernier calliper.
   (i) Vernier scale
   (ii) Main scale
   (iii) Inner jaws
   (iv) Outer jaws.
   (v) Probe

   (c) What is the reading in each of the following ?

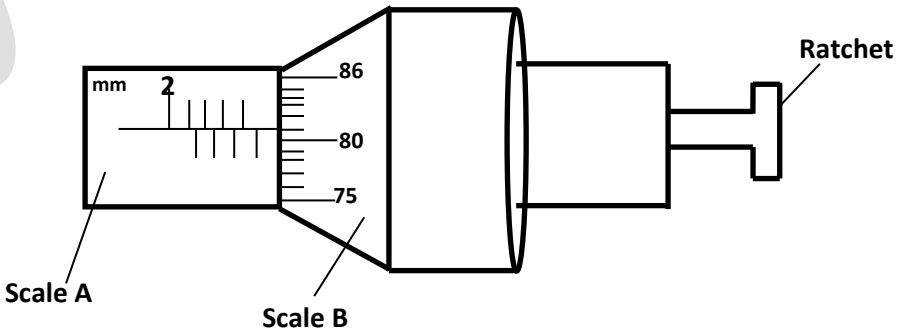




[8]

[TOTAL: 8MARKS]

4. Study the figure below and answer questions that follow.



   (a) State the function of the ratchet [1]
   (b) Name the scales A and B . [2]
   (c) State two precautions which should be taken when using the instrument above. [2]
   (d) Name the instrument shown above and state its accuracy in

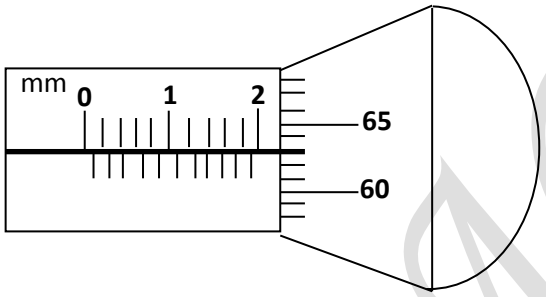
(i) mm
(ii) cm [2]

(e) What is the reading on
(i) Scale A [1]
(ii) Scale B [1]

(f) What is the reading on the instrument above . [1]

[TOTAL: 10MARKS]

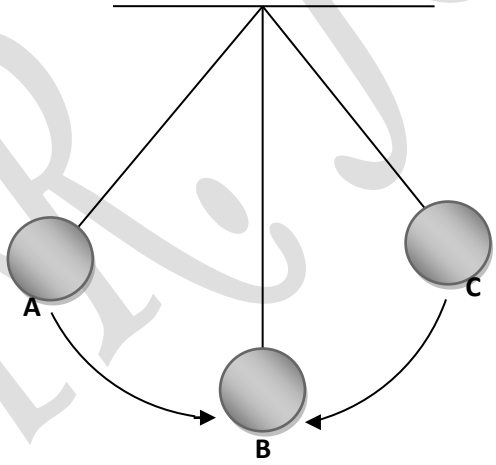
5. Study the micrometer screw guage below.



(a) Explain in details how you can use the instrument above to measure the diameter of a copper wire. [4]
(b) What physical quantity does a micrometer screw guage measure? [1]
(c) What is the reading shown on the instrument above? [1]
(d) Name other instruments which could be used to measure the physical quantity mentioned in (c) above. [1]
(e) A micrometer screw guage registers a reading 4.25mm and the zero error is - 0.06mm .What is the actual reading ? [1]

[TOTAL: 8MARKS]

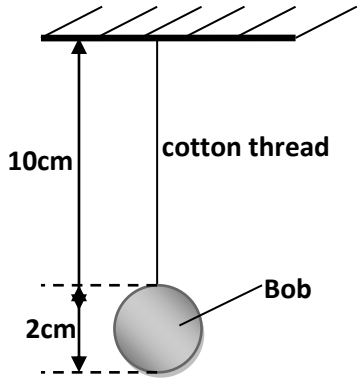
6.The diagram below shows a pendulum



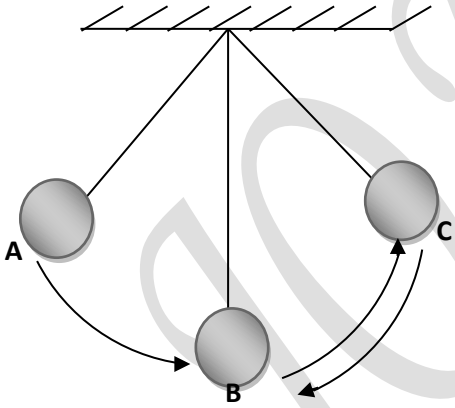
(a) What is a simple pendulum ? [1]
(b) The bob was found to have moved from point A to point B in 0.2 second and then to point C .Calculate the periodic time of the pendulum. [1]
(c) Explain how the bob should move to make a complete swing. [2]
(d) What do we call the time taken for the pendulum to make a complete oscillation? [1]

[TOTAL: 5MARKS]

7. The diagram below represents a pendulum hung from a fixed support .Find the length of the pendulum .

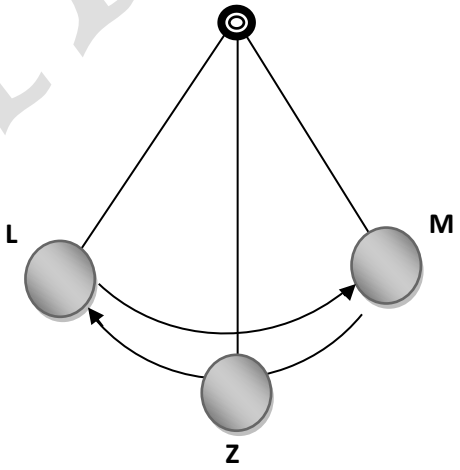


8. The diagram below shows a simple pendulum that oscillates between position A and C .It takes 2.05 s to go from A to C and back To mid- point B

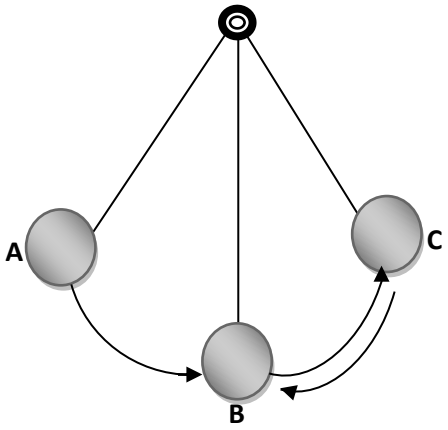


(a) (i) Calculate the period of the pendulum [1]
(ii) Calculate the frequency of the pendulum [1]
(b) Briefly describe how the period of the pendulum would be measured. [3]
[TOTAL: 3MARKS]

9. It takes 1.28 seconds a pendulum to swing from L to M and back .How long does the ball take to move from M to Z?



10. The diagram below shows a pendulum.



If the bob of the pendulum takes $\frac{1}{4}$ Seconds to swing between the extreme positions A and C .

(a) What is the frequency of the oscillation? [1]

(b) State whether the frequency of the oscillation will increase, decrease or remain the same if

(i) The length of the string is increased. [1]

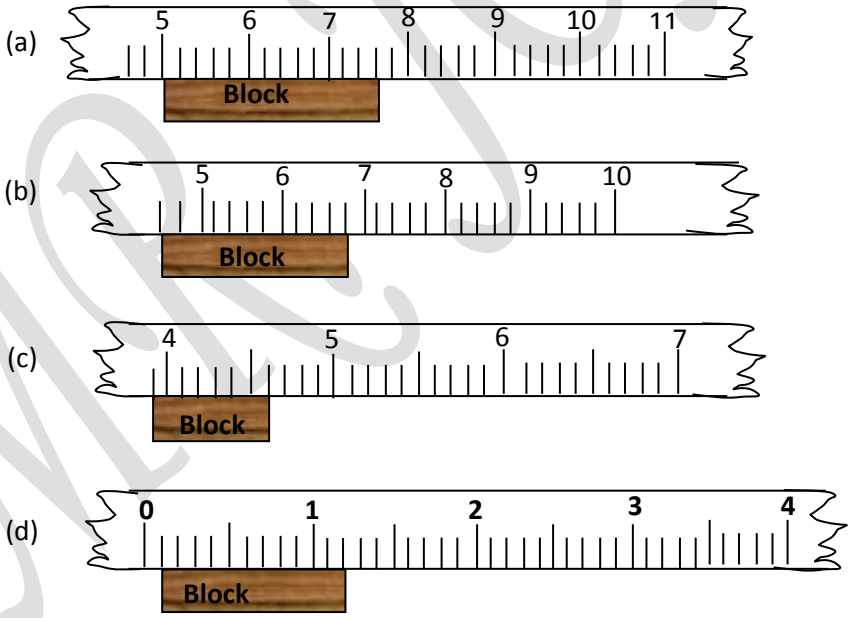
(ii) The mass of the bob is increased (without alternating the size of the bob). [1]

(iii) Distance between A and C decrease. [1]

[TOTAL: 4MARKS]

11. The figure below shows four meter rulers being used by grade 10 pupils at **CHIKOLA SECONDARY SCHOOL** to measure the sides of a concrete block, all of them are eaten by a remit.

(i)What is the length of a block in each case?



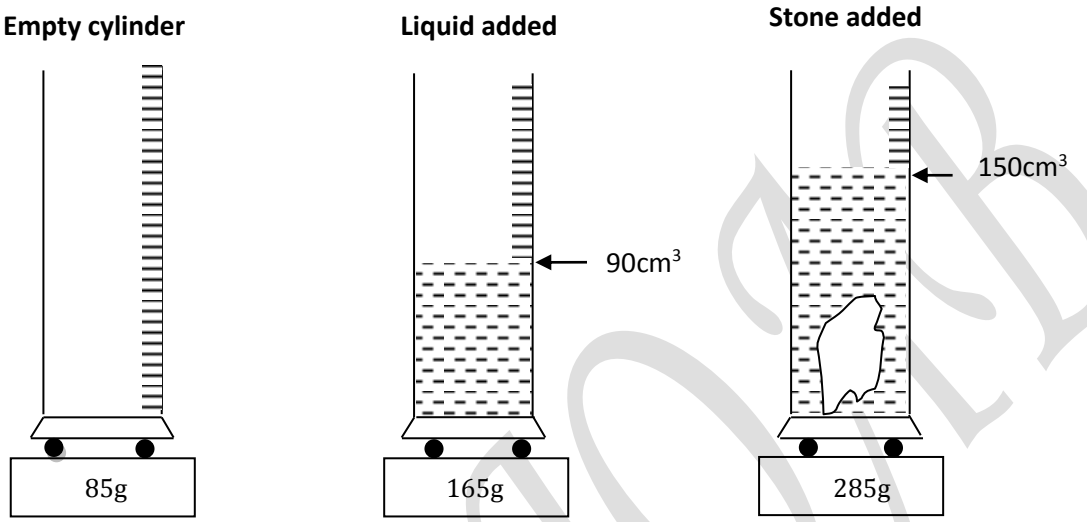
(ii) Explain briefly how a meter rule can be used to measure the length of a small regular object such as Hard cover book.

MASS WEIGHT AND DENSITY

12.(a) Define the term mass [1]

(b) In an experiment to determine the mass of a certain volume of paraffin, the mass of the empty beaker Was found to be 30g.when the paraffin was poured into the beaker the mass increased to 38.5g. What was the Mass of the Paraffin?

(c) In a physics lesson Mr Musonda J measured and calculated the mass, volume and density of the liquid and the stone using a measuring cylinder and an electronic beam balance as shown below.



Use the information above to calculate

(i)the mass of the liquid

(ii)the volume of the liquid

(iii)the density of the liquid

(iv)the mass of the stone

(v)the volume of the stone

(vi)the density of the stone [2]

[TOTAL: 3MARKS]

13.(a)A bottle filled with the mass of 22g has a mass of 53.2g . Find the mass of the empty bottle [1]

(b) State three differences between mass and weight [3]

(c) The value of 'g' is 10N/kg on the earth and 1.5N / kg on the moon .An astronaut who has a mass of 90kg on the earth goes to the moon. What are the values of?

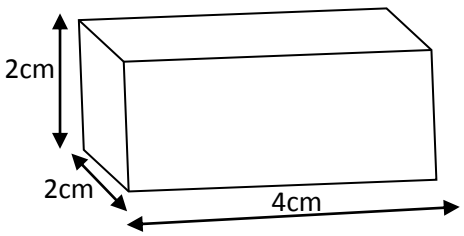
(i) His weight on the earth [1]

(ii) His mass on the moon [1]

(iii) His weight on the moon [1]

[TOTAL: 6MARKS]

14. The diagram below shows the dimensions of a metal block whose mass is 80g



(a) Define
  (i) Volume [1]
  (ii) Density [1]
(b) State the formula connecting density and volume. [1]
(c) (i) Calculate the volume of the metal block above.
(d) (ii)Calculate the density of the metal block. [1]

[TOTAL: 4MARKSS]

15. Describe an experiment you can carry out to determine the density of
(a) Small irregular shape object. [4]
(b) A liquid e.g water [4]
(c) A regular solid e.g brick [4]
(d) A floating object e.g cork [4]

[TOTAL: 16MARKS]

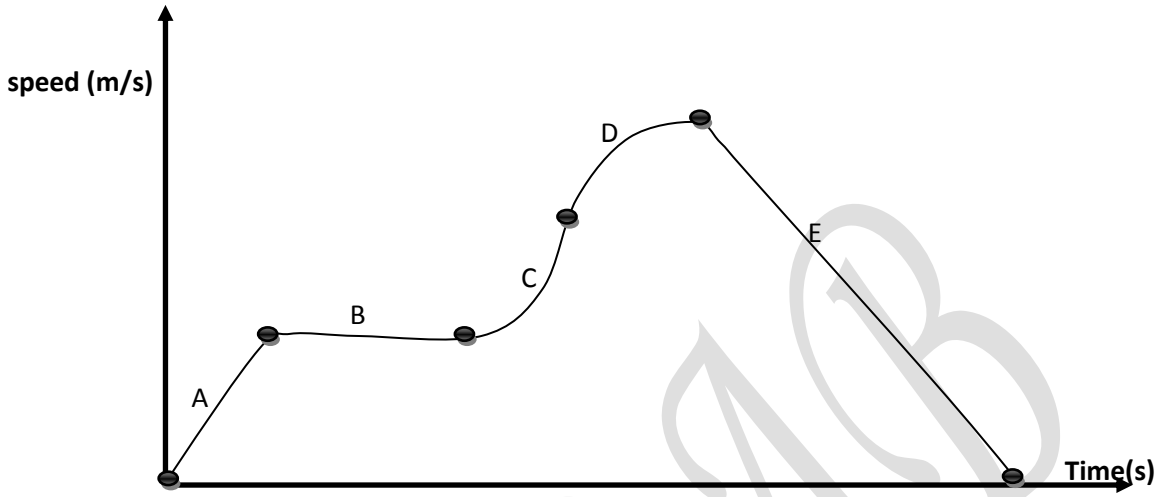
16. (a)The mass of a bus is 5000kg .Calculate the weight of the bus (g = 10N/kg). [1]
(b)The weight of an elephant is 1200N .Calculate the mass of the elephant.(g=10N/kg)
(c)The mass of the rugby ball is 200g.Calculate the weight of the rugby ball.

17. The mass of a 50cm length of wire was 3.5g.The cross section of wire was 0.01cm^3.
(a) What is the volume of the wire? [1]
(b) Calculate the density of the wire. [1]
(c) Name an instrument that could be used to obtain an accurate value for the diameter of the wire. [1]

[TOTAL: 4MARKS]

KINEMATICS

18. The graph shows how the speed of an object changes with time.



Which section of the graph shows the object moving with?

(a) Constant acceleration [1]
(b) Constant deceleration [1]
(c) Decreasing acceleration [1]
(d) No or zero acceleration [1]
(e) Increasing acceleration [1]
(f) Constant speed [1]

[TOTAL: 6MARKS]

19. A motor cycle travelling at 10m/s accelerates at 4m/s^2 for 8s.

(a) Find its final velocity [1]
(b) How far does it travel during the 8s [1]

[TOTAL: 2MARKS]

20. (a) Define the term velocity [1]
(b) The car has a steady speed of 8m/s [1]
(i) How far does the car travel in 8s [1]
(ii) How long does the car take to travel in 160m? [1]

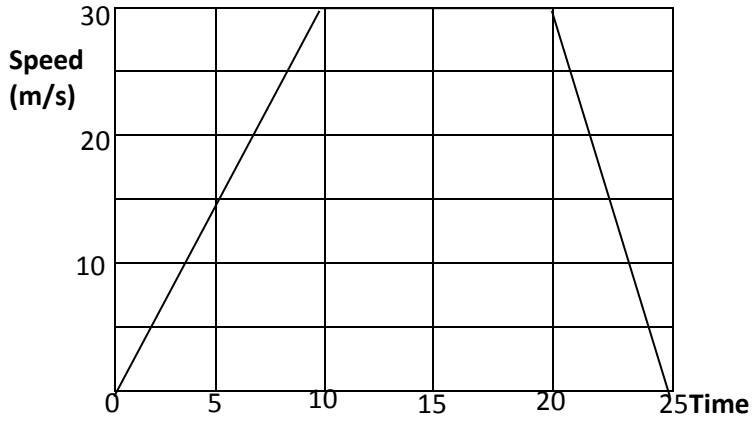
[TOTAL: 4MARKS]

21. A stone is thrown upwards with initial velocity at 20m/s .Air resistance is ignored and g = 10m/s^2.

(a) Calculate how far it went to the top. [1]
(b) How long does it take to reach the top? [1]
(c) What is its velocity just before it reaches the ground? [1]
(d) How long does it take to return to the ground? [1]
(e) For this stone draw
(i) A speed -time graph [2]
(ii) A velocity -time graph [2]

[TOTAL: 8MARKS]

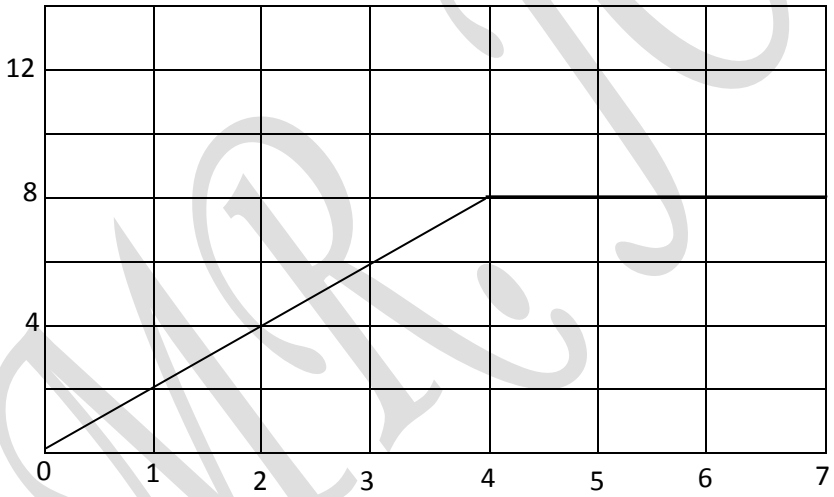
22. The speed –time graph below for a motor cycle travelling along the road.



(a) What is the motor cycle's maximum speed? [1]
(b) What is the acceleration during the first 10s? [1]
(c) What is the deceleration during the last 5s? [1]
(d) What is the distance travelled during the first 10s? [1]
(e) What is the total distance travelled? [3]
(f) What is the time taken for the whole journey? [1]
(g) What is the average speed for the whole journey? [1]

[TOTAL: 9MARKS]

23. The figure below shows a speed time-graph for an object moving along a horizontal straight track.

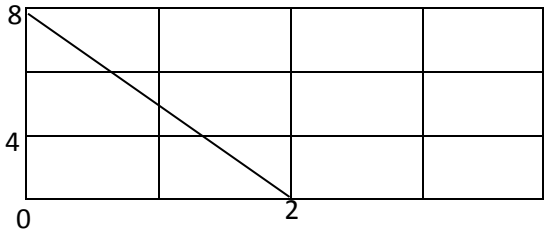


(a) What is meant by 12m/s of an object? [1]
(b) Calculate the acceleration of the object during the time [1]
(i) 0 to 4 seconds (ii) 4 to 6 seconds [2]

(c) Calculate the distance moved during the first part of the journey. [2]

[TOTAL: 6MARKS]

24. The graph below shows how the velocity of the ball changed when it was rolled up a smooth slope with an Initial speed of 8m/s



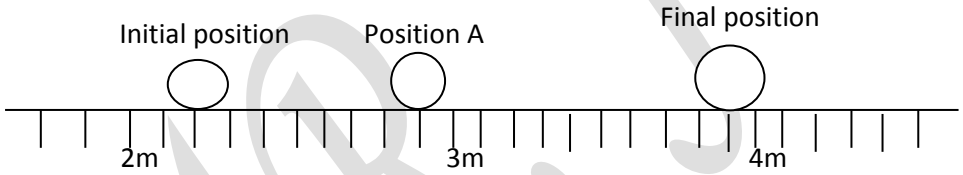
(a) At what time did the ball reach the highest point on the slope? [1]
(b) Calculate the greatest distance covered by the ball from the starting point [1]
(c) Calculate the acceleration of the ball as it moved up the slope [1]
(d) At what time would the ball return to its starting point? [1]
(e) Convert the graph above into a complete
(i) Velocity time graph. [1]
(ii) Speed time graph. [1]

[TOTAL: 6MARKS]

25. (a)A Car has the acceleration of $2m/s^2$. What does the statement above mean? [1]
(b) Define acceleration [1]
(c) A car is moving at 30m/s in Chiwempala road where the speed limit is 100km/hr. State whether the car is Over speeding or not. Show your work. [1]

[TOTAL: 3MARKS]

26. To investigate the change in distance with times a student rooled a tyre on a marked flow. The diagram below shows the position of the tyre on the marked flow.



The tyre takes 3s to move from the initial position to point A and 2s to move from position A to the final position.
(a)what is the time taken for a tyre to move from the initial position to the final position? [1]
(b) Calculate the distance between the initial position and position A? [1]
(c) Calculate the distance between position A and the final position? [1]
(d) What is the total distance covered by the tyre? [1]
(e) Find the speed of the tyre between the initial position and point A? [1]
(f) Find the speed of the tyre between position A and the final position? [1]
(g) Find the average speed of the tyre? [2]

[TOTAL: 4MARKS]

27.(a)define the term velocity [1]
(b) Explain why velocity is said to be a vector quantity. [1]
(c) Explain why it possible for an object to be accelerating even if its speed is constant. [2]

[TOTAL: 4MARKS]

DYNAMIC: FORCE & MOTION

28.(a) Define the following terms

(i) Force (ii) friction (iii) inertia. [3]

(b) What are the SI units for the following quantities in words and symbols?

(i) Force (ii) mass (iii) weight (iv) Acceleration [4]

(c) State the relationship between (i) (ii) and (iv) [1]

[TOTAL: 8MARKS]

29.(a) A force of 320N acts on an object of mass 16.8kg .What acceleration does it produce? [1]

(b) What force is required to push a mass of 3kg at a constant acceleration of $2m/s^2$ [1]

[TOTAL: 2MARKS]

30. A car of mass 400kg starts from rest and attains a velocity of 30m/s in 5s

(i) Find its acceleration [1]

(ii) Calculate the resultant force. [1]

(iii) How far did the car travel in 5s [1]

[TOTAL: 3MARKS]

31. Mr. Musonda J pushes a crate of mass 15kg across a floor at a constant speed by applying a force of 75N.

(i) What is the acceleration of the crate [1]

(ii) How big is the force of friction which acts on the crate? [1]

(iii) Into what forms of energy is the work done on the crate being converted? [1]

[TOTAL: 3MARKSS]

32.. (a) Give two

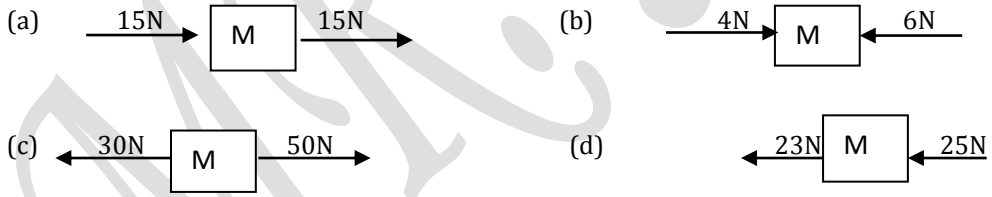
(i) Disadvantages of friction [2]

(ii) Advantages of friction. [2]

(b) State three effects of a force [3]

[TOTAL: 7MARKS]

33. Study the action of force on a mass M in the arrangements below.



(i) Which arrangement above has a largest resultant force?

(ii) Which arrangement can give the greatest acceleration to mass M? Explain your answer.

(iii) State the direction in which the mass M will move in each arrangement above [7]

34. (a) State Hooke's law [2]

(b) A load of 4N extends a spring by 10mm .what load would extend it by 15mm? [1]

(c) A 3N load extended a spring by 9mm and another load was added and it extended to 12mm. What was the total load ? [2]

(d) What load can extend a spring by 16mm if a 5N force extends it to 13mm?

(e) A spring stretched 10cm when a force of 600N is applied .Calculate the extension when force of 800N is applied on it in Metres. [1]

(f) Define the following

(i) Elasticity (ii) Extension (iii) Elastic Limit. [3]

(g) Describe an experiment you would carry out to produce an accurate extension – load graph for a spiral spring ,and check that the limit of proportionality was not exceeded. Assume that the maximum load to be used is 6N and the value of the gravitational field strength on the Earth (g) is 10N/kg. [8]

[TOTAL: 9MARKS]

Part one

35. The table below shows the reading taken in a spring –stretched experiment.

Load/N	0	1	2	3	4	5	6
Length /mm	40	49	58	67	76	88	110
Extension /mm							

(a) What is the unscratched length of the spring? [1]
(b) Copy and complete the table [1]
(c) Plot a graph of extension against load. [2]
(d) Mark the elastic limit on your graph with letter X [1]
(e) Over which section of the graph line is the extension proportional to the load? [1]
(f) What load would make the spring stretched to a length of 65mm? [1]

[TOTAL: 7MARKS]

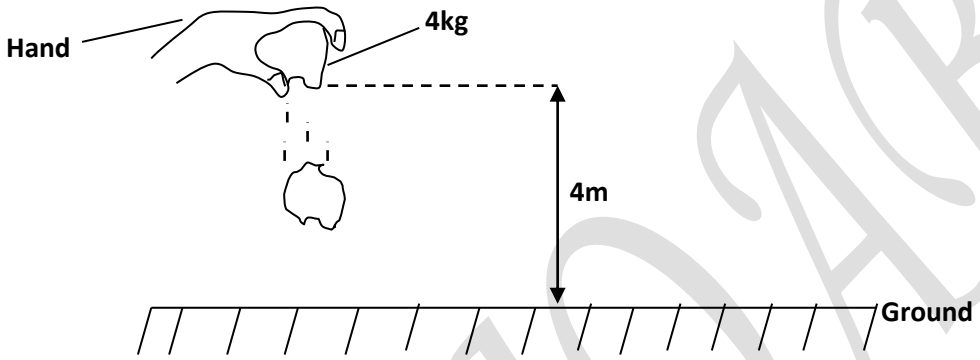
Part two

WORK, ENERGY AND POWER

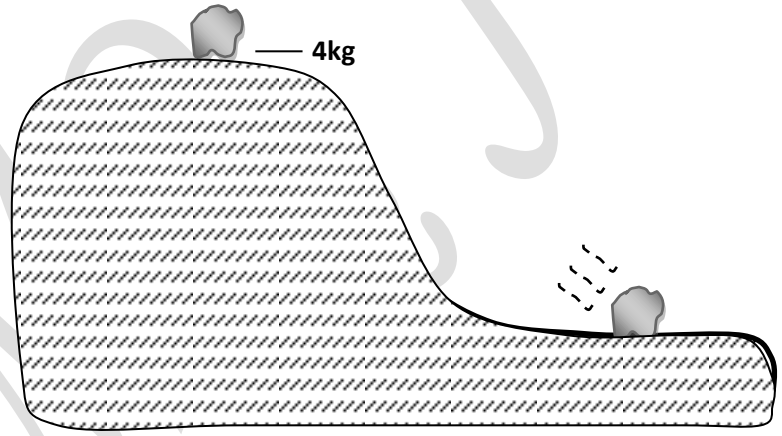
35. 50J work must be done to lift a vase from the ground up to a shelf
    (a) How much potential energy does the vase have when it is on the shelf [1]
    (b) If the vase falls from the shelf, how much kinetic energy does it have just before it hits the ground? (Assume that air resistance is negligible. [1]
    (c) What happens to this energy after the vase has hit the ground? [1]
    (d) State the law of conservation of energy. [1]

[TOTAL: 4MARKS]

36.(a)If a stone is dropped ,as shown below ,what is its kinetic energy when it has fallen half –way to the ground?



(c)The stone on the diagram below slides down a smooth slop. What is its speed when it reaches the bottom? (g= 10N/kg)



37. A ball of mass 0.5kg dropped from a cliff top, the ball hits the sea below at a Speed of 10m/s.
    (a) What is the kinetic energy of the ball as it is about to hit the sea? [1]
    (b) What was the ball's gravitational potential energy before it was dropped? [1]
    (c) From what height was the ball dropped? [1]

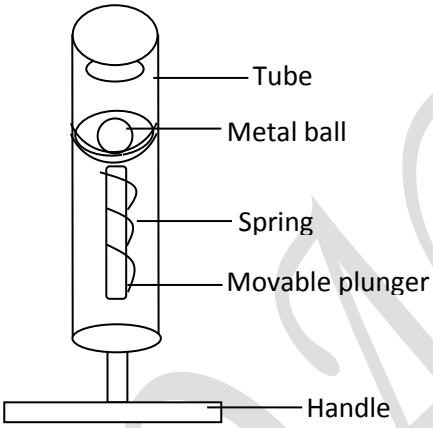
[TOTAL: 3MARK]

38. A motor has a useful power output of 3kw
    (a) What is its useful power output in watts?.
    (b) How much useful work does it do in 1second? [1]
    (c) How much useful work does it do in 20second? [1]
    (d) If the power input to the motor is 4kw, what is the efficiency? [2]

[TOTAL: 4MARKS]

39. (a) Explain what you understand by the phrase **non renewable energy resources.** [1]
(b) Explain why most non-renewable energy resources are burned. [1]
(c) Name a non renewable resource which is not burned [1]
(d) Give two advantages of renewable resource of energy over non-renewable resource of energy. [2]
[TOTAL: 5MARKS]

40. A rope of toy catapult below consist of a movable plunger which has a spring attached as Shown below.

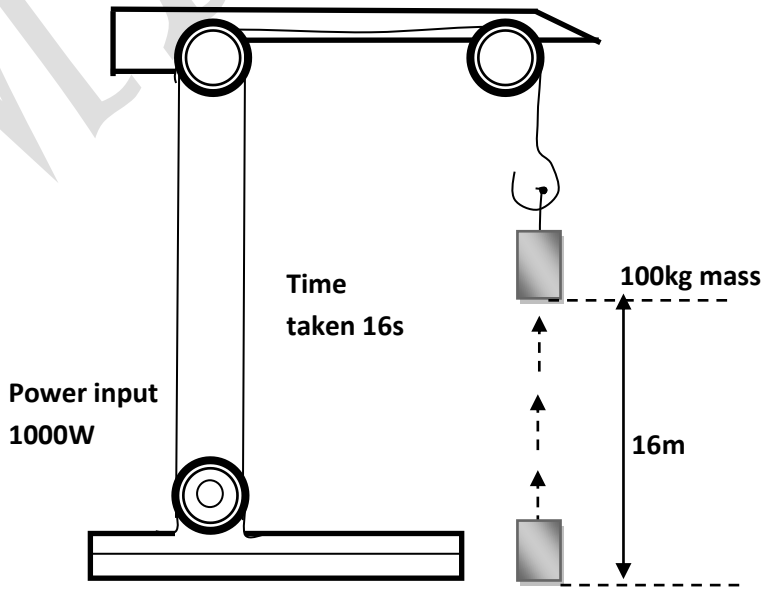


The handle was pulled down to fully compress the spring and on release the metal ball of mass 0.1kg (weight 1N) was Projected 75 cm vertically.

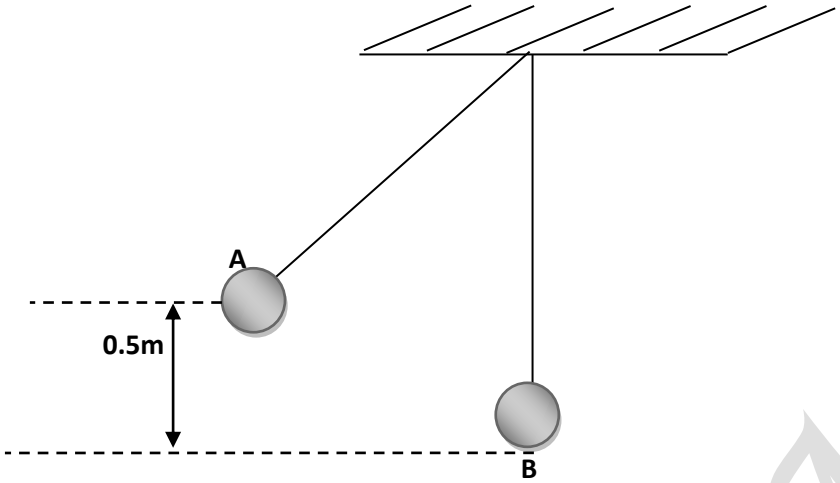
(a) (i)What type of energy is stored in a compressed spring? [1]
(ii) What happens to this stored energy when the handle of the plunger is released? [2]
(b) Calculate the maximum potential energy acquired by the metal ball from the catapult. Write down the formula that You can use and show your work. Take the acceleration due to gravity to be $10m/s^2$. [3]
(c) Explain why the maximum potential energy gained by the metal ball is less than the original stored energy of the spring. [3]
[TOTAL: 9MARKS]

41. (a) Define the following terms.
(i) Work (ii) energy (iii) power (iv) efficiency [4]

(b) The crane below lifts a 100kg block of concrete through a vertically height of 19m in 20s.If the power input to the motor Is 1000w, what is the efficiency of the motor? [3]



42. When the 2000g pendulum bob was pulled to position A, it was raised to a height of 0.5m as shown in below



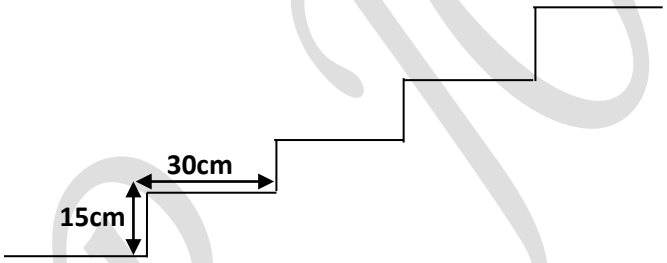
If it was released from point A and swings down to point B

(i) Show that the velocity of the pendulum bob is independent of its mass [4]

(ii) Calculate the velocity of the ball at point B [4]

[TOTAL: 8MARKS]

43. The diagram below shows a set of five steps. A student of mass 50kg runs up the steps in 5s



(a) Define Potential energy. [1]

(b) What is the student's gain in gravitational potential energy ? [1]

(c) Calculate the power exerted by the student. [1].

[TOTAL: 3MARKS]

44. A 2kg stone is dropped from the top of a 20m tall building as shown below .

(a) What is its potential energy at this height ? [1]

(b) What is its K.E at this height ? [1]

(c) What is its K.E as it hits the ground again? [2]

(d) With what velocity will it hit the ground ? [1]

[TOTAL: 5MARKS]

45.(a) Define power [1]

(b) Calculate the power required for a force 10N applied to move a 10kg box at a speed of 2m/s over a Frictionless surface . [2]

(c) A machine can lift 200kg to height of 100m in 20s .What is the useful power of the machine. [1]

(d) Differentiate gravitational potential energy from elastic potential energy. [1]

[TOTALA: 5MARKS]

46.(a) Define efficiency of a machine. [1]

(b) Find the efficiency of an electric motor that is capable of lifting a 80kg mass through a height of 20m after consuming 40kj of Electrical energy. [2]

(c) Find the efficiency of an electric motor that is capable of pulling a 50kg through a height 15m after consuming 50kj of electrical energy. [2]

(d) A labourer applies a vertical force of 35N on a lever through a distance of 2m in order to raise a load of 80N through a distance of 80cm .What is his efficiency? [1]

[TOTAL: 6MARKS]

47. A ball has a mass of 0.5kg dropped from a cliff top, the ball hits the sea below at a speed of 10m/s.

(a) State the law of energy conservation [1]

(b) What is the kinetic energy of the ball as it is about to hit the sea? [1]

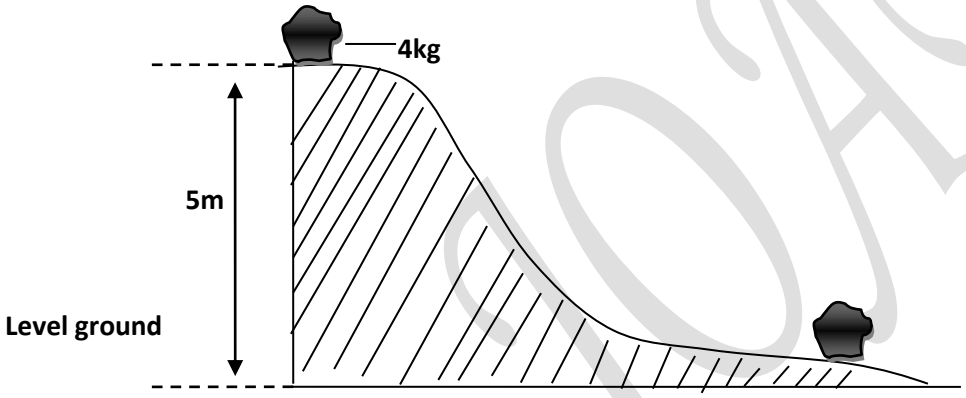
(c) What was the ball's gravitational potential energy before it was dropped? [1]

(d) From what height was the ball dropped? [1]

[TOTAL: 4MARKS]

48. If a 4kg stone is dropped from a height of 4m, what is its kinetic energy when it has fallen half-way to the ground? [1]

49. The diagram below shows a 4kg stone rose to a height of 5m of an anthill



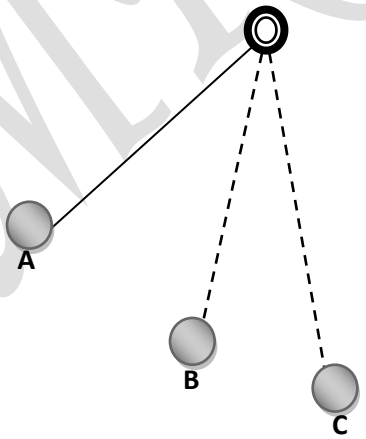
(a) What energy does the tore have at the top of the anthill?

(b) Describe the energy changes as the stone slides down the slope.

(c) What is its speed when it reaches the bottom of the level ground?

(d) What would be the speed of the stone if it fell vertically rather than sliding?

50. The diagram below shows a pendulum which was released from position A



(a) What form(s) of energy did the pendulum have at (i) A (ii) B (iii) C [3]

(b) Eventually the pendulum would stop moving. Explain what has happened to the initial energy of the Pendulum. [1]

[TOTAL: 4MARKS]

51. A pendulum bob of mass 2kg is raised to a height of 1m above its lowest point .It is then raised.

(a) What is its potential energy at this height? [1]

(b) What is its maximum kinetic energy? [1]

(c) Find its maximum velocity? [1]

[TOTAL: 3MARKS]

52. A folk lifter lifts a crate of mass 100kg at a constant velocity to a height of 8m over a time of 4 seconds. The lifter then holds the Crate in place for 20 seconds. Calculate how much power the folk lifter exerts in lifting the crate.

[2]

53. A rock of mass 200kg is dropped from a height of 200m.

(a) What is the potential energy and kinetic energy at?

(i) 0 seconds (ii) 2 seconds (iii) 4 seconds (iv) Just before it hits the ground? [4]

(b) With what velocity does it hit the ground? [2]

[TOTAL: 6MARKS]

54the table below lists devices which involve energy conservation .complete the table to show the main type of energy produced and the form of energy as a source.

Device	**Form of energy before use**	**Form of energy after use**
Electrical lamp	1.	Light
Bunsen berner flame	Chemical	4.
Petrol engine	2.	Heat
loudspeaker	Electrical and kinetic	5.
Brake pads	3.	Heat
Light bulb	Electrical	6.

[TOTAL: 6MARKS]

55.(a) Describe the energy changes which take place when a pendulum is oscillating. [2]

(b) Describe the energy changes which take place as the pendulum comes to rest. [1]

(c) (i) Differentiate renewable source of energy from non renewable source of energy. [1]

(ii) Give two examples of renewable and non renewable sources of energy . [2]

(iii) List three forms of energy. [3]

[TOTAL: 9MARKS]

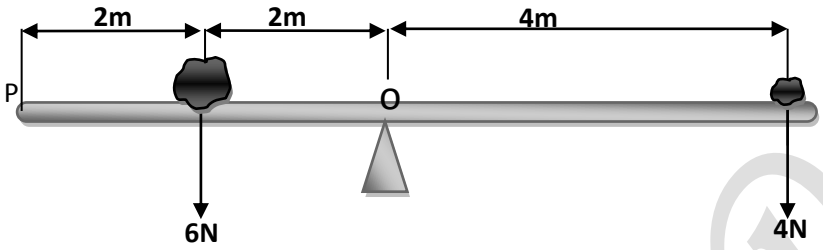
MOMENTS & STABILITY

56. In the diagram below Mr Joab is trying to balance a plank with a stone .The plank has negligible weight.

(a) State two conditions to consider for an object to be in equilibrium.

(b) State the principle of moments.

(c)



(i) Calculate the moment of the 4N force about O. [1]

(ii) calculate the moment of the 6N force about O. [1]

(d) Will the plank balance with the 6N and 4N weight, if not ,which way will it tip? [1]

(e) Using the principle of moments find the extra force needed at P to balance the plank. [1]

(f) In which direction must the force at P act ? [1]

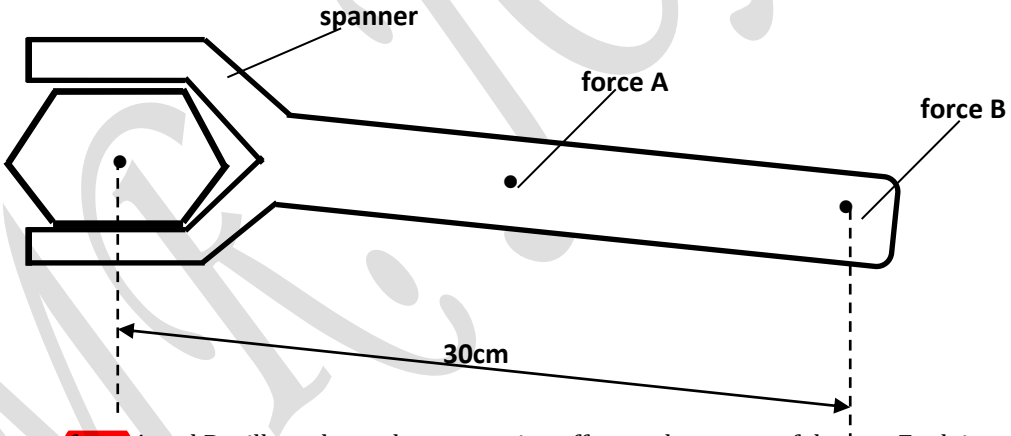
[TOTAL: 5MARKS]

57.(a)(i) What is meant by the moment of a force about a point? [1]

(ii) If an object is in equilibrium under the action of many forces, what can be stated about the moments [1]

[TOTAL: 2MARKS]

58. The figure below shows a spanner used by Mr. Joab during wheel alignment to untie a nut.



(a)(i) Which of the two force A and B will produce a larger turning effect at the centre of the nut. Explain your answer [2]

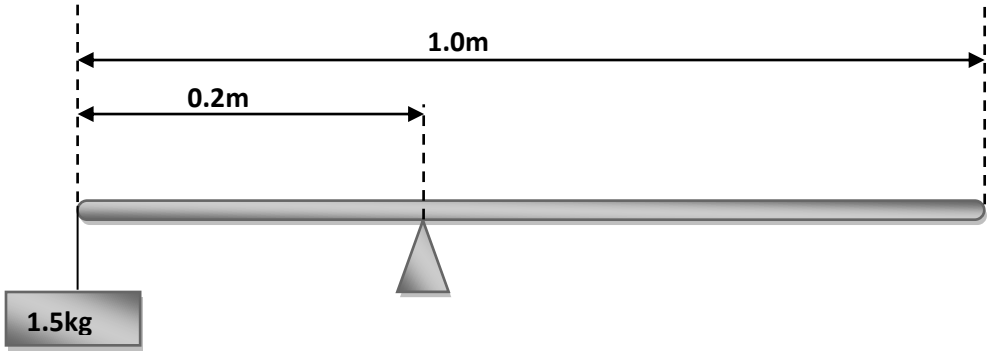
(ii) Calculate the turning effect at the centre of a nut if a 2N force is applied at B [1]

(iii) Explain why a spanner shown above considered to be a machine. [1]

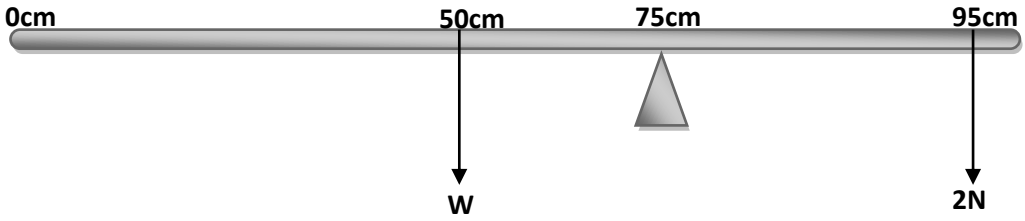
(b) Give two other examples of application of moments in everyday life situations [2]

[TOTAL: 6MARKS]

59. If a uniform bar balance as shown below with a 1.5kg mass attached to one end .Find the weight of the bar. (g = 10N /kg)

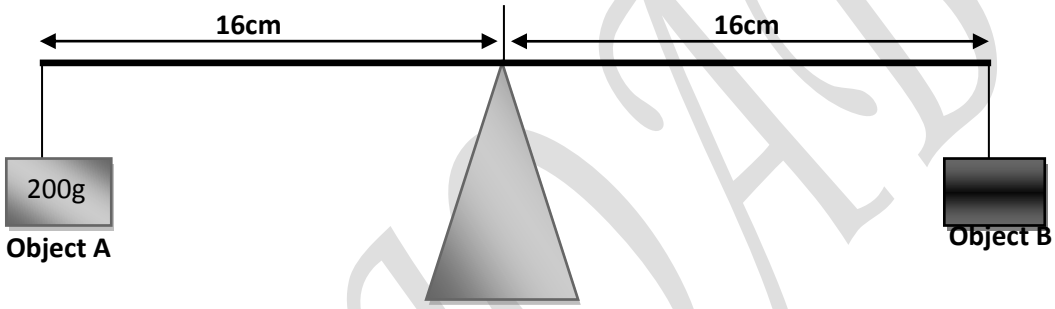


60. The diagram below shows a uniform metre rule, weight W, pivoted at the 75cm mark and balanced by a force of 2N Acting at the 95cm mark



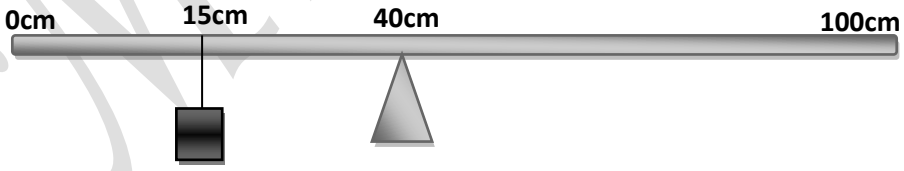
(a) Calculate the moment of the 2N force about the pivolt. [1]
(b) Use the principle of moments to calculate the value of W in Newton's. [2]
[TOTAL: 3MARKS]

61. The diagram below shows a balance in use .Object A is balance by object B .Take g = 10N/kg.



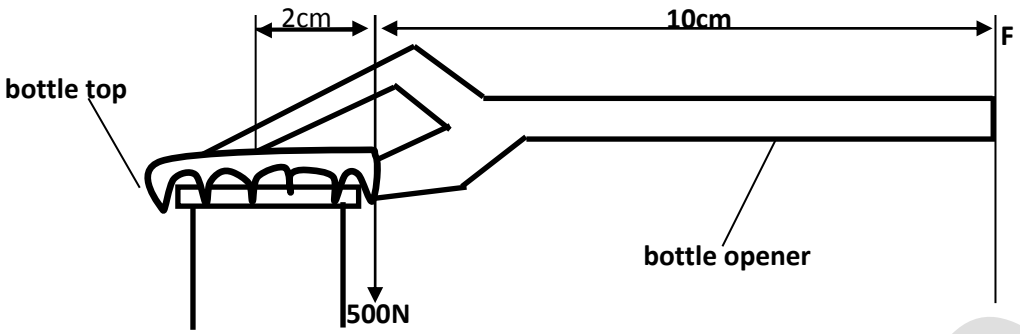
(a) What is the weight of object B? [1]
(b) Calculate the moment of the weight of object B about the pivot. [1]
(c) (i) What would the object B weigh on the moon ,where g = 1.7N/Kg? [1]
(ii) Explain why the object would still be balanced by the same mass if the balance was on the moon. [1]
[TOTAL: 4MARKS]

62. (a) Explain what is meant by the centre of gravity of an object. [1]
(b) Describe how you would find by experiment the centre of gravity of a thin, irregularly shaped sheet of metal. [4]
(c) Explain why a minibus is more likely to topple over when the roof-rack is heavily loaded than when the roof-rack is empty. [1]
(d) A metre rule is supported on a knife - edge placed at the 40cm graduation .It is found that the metre rule balances horizontally.
When a mass which has a weight of 0.45N is suspended at the 15cm graduation, as shown in the diagram below.



(i) Calculate the moment, about the knife -edge in this balanced condition, of the force due to the mass of the rule . [1]
(ii) If the weight of the rule is 0.90N, calculate the position of its centre of gravity [1]
[TOTAL: 8MARKS]

63. The diagram below shows a bottle opener

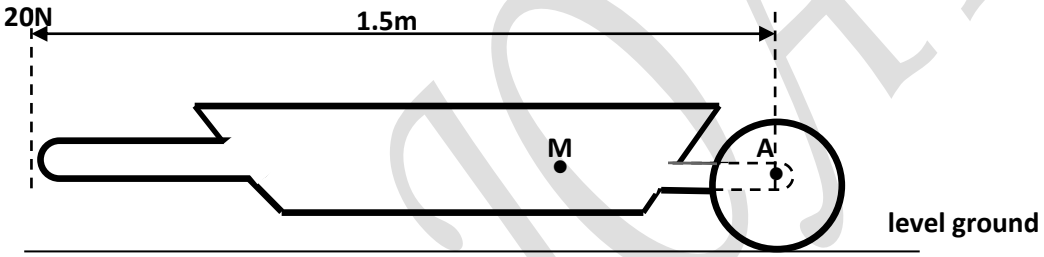


(a) State the principle of moments. [2]

(b) Calculate the force F needed to remove the bottle top. [2]

[TOTAL: 4MARKS]

64. The figure below shows an empty wheel barrow which weights 80N .The operator pulls upwards on the handle With a force of 20N to keep the handle horizontal. The point marked M is the centre of mass of the wheel barrow.



(a) Copy the figure and draw arrows to show the other two vertical forces that act on the wheelbarrow [2]

(b) Determine

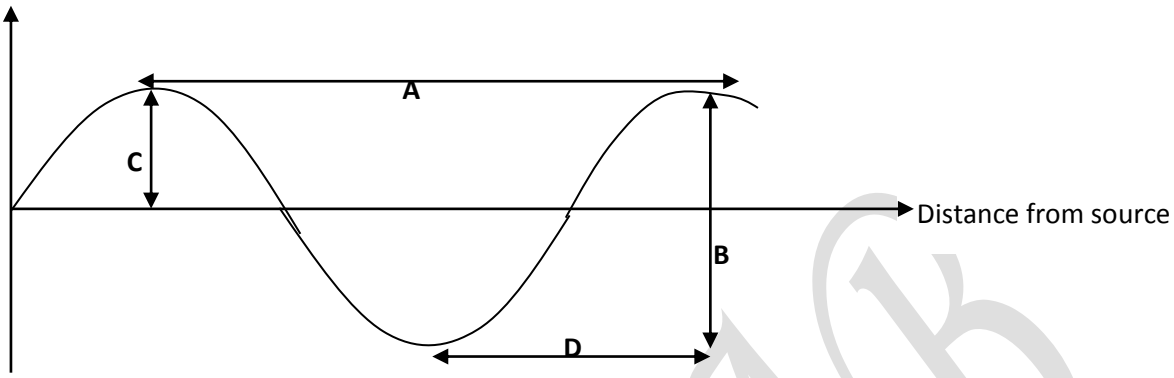
(i) The moment of the 20N force about the centre of the wheel A [1]

(ii) The distance between points A and M [2]

[TOTAL: 5MARKS]

WAVE MOTION & SOUND

65. A sound wave travelling through air can be represented as shown in the diagram



Which distance A, B, C OR D represents

(i) One wavelength [1]

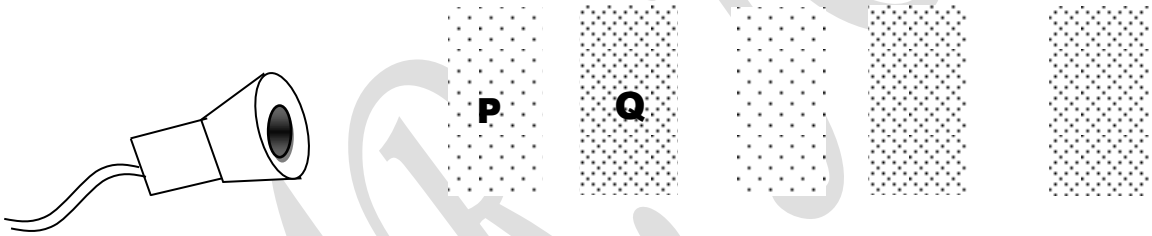
(ii) The amplitude of the wave [1]

(iii) Copy the above diagram and label another distance E which is equal to one Wavelength [1]

(iv) What is the frequency of a sound wave with speed 34m/s and wavelength 0.5m [1]

[TOTAL: 4MARKS]

66.. The cone of a loud speaker is vibrating .The diagram shows how the air particles are spread out In front of the cone at a certain time



(a) Identify the regions P and Q [2]

(b) Describe how the pressure in the air changes from P and Q [2]

(c) Describe the motion of the air particles as the sound wave passes [2]

(d) Copy the diagram of air particles above and mark and label a distance equal to the wavelength of the sound wave [1]

(e) A cannon at a distance of 1700m from an observer is fired at340m/s. Calculate the time taken for the sound to reach the observer [1]

[TOTAL:7MARKS]

67. (a) (i) Explain the difference between longitudinal and transverse waves [1]

(ii) Give one example of each kind of wave. [1]

(b) Explain how waves transfer energy from one place to another. [2]

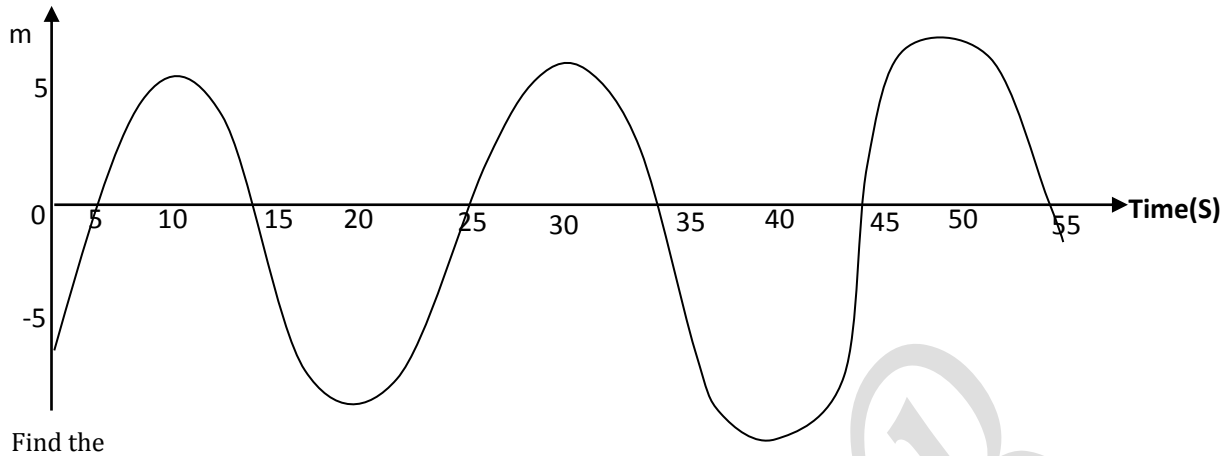
(c) Ripples are sent across a pond and a small floating object goes up and down six times in 15 seconds. If the wave crest are 40cm apart, calculate the

(i) Period of the wave [2]

(ii) Speed of the wave [2]

[TOTAL: 8MARKS]

68.The diagram shows a displacement –time graph for a progress wave



Find the

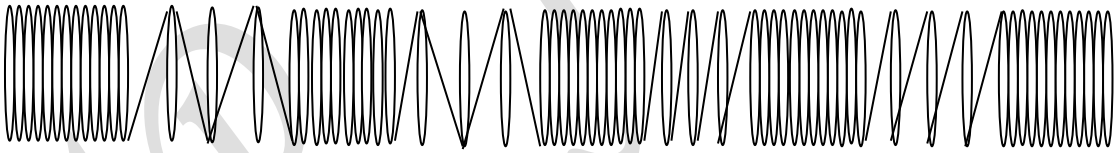
(a) Value of the amplitude [1]
(b) Period for a wave [1]
(c) Frequency of the wave [1]
(d) Wavelength if its speed is 1.02m/s [1]

[TOTAL: 4MARKS]

69.(a) state what is meant by

(i) Frequency [1]
(ii) Wavelength [1]
(iii) Amplitude [1]

(b) The diagram below shows waves generated on a spiral spring.



Indicate the following on the diagram

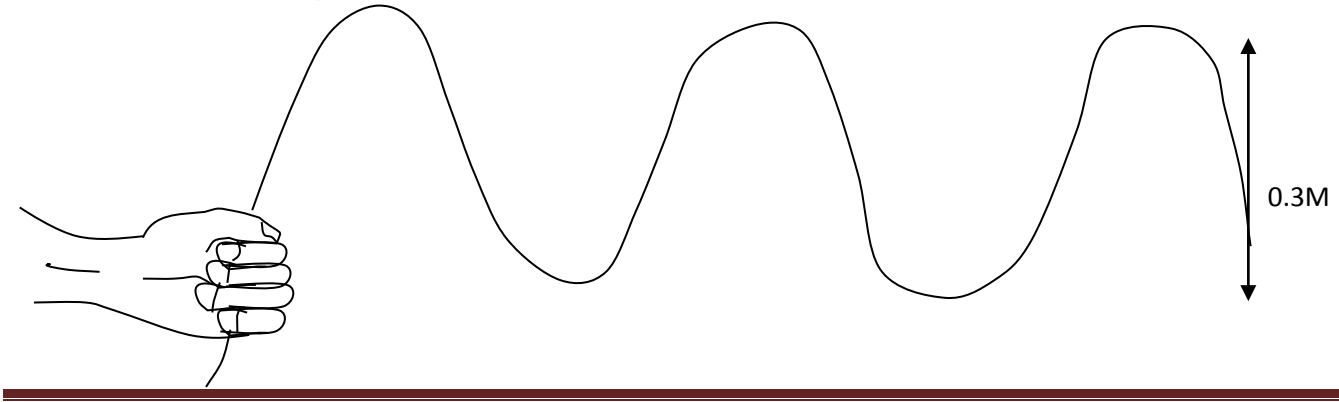
(i) Compression(C) and rarefaction(R) [2]
(ii) Wavelength of the wave. [1]

(c) What type of a wave is shown in the diagram above? [1]
(d) In what way(s) does the vibration which take place in a sound wave differ from that in a transverse wave? [2]
(e) If the source vibrate at a frequency of 20Hz and produces waves of wavelength 0.02m, at what speed do these waves travel Out from the source? [2]

[TOTAL: 11MARKS]

70.A student setting up waves on a long elastic cord .The student's hand makes one complete up and down movement in 0.4s and in each

Up and down movement the hand moves through a height of 0.3m.the wavelength of waves in the string is 0.8m



For this wave, determine

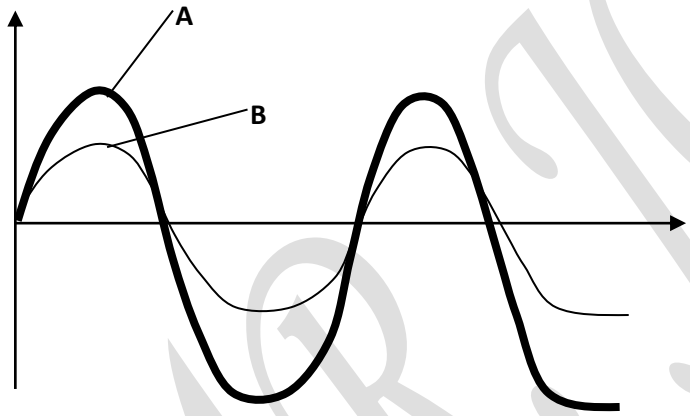
(i) The amplitude [1]
(ii) The frequency [1]

71.(a) define wave speed [1]
(b) Draw a diagram to help you explain the amplitude and the wavelength of a transverse wave. [2]
(c) State the formula connecting the frequency and the wavelength of any wave. [1]
(d) An observer is watching a thunderstorm to the north .A roll of thunder is heard 6s after seeing the flash of lightening and its echo From a range of hills to the south is heard after another 6s.calculate the distance from the observer of

(i) The storm [2]
(ii) The hills [2]

Assume the speed of sound in air is 330m/s. [TOTAL: 8MARKS]

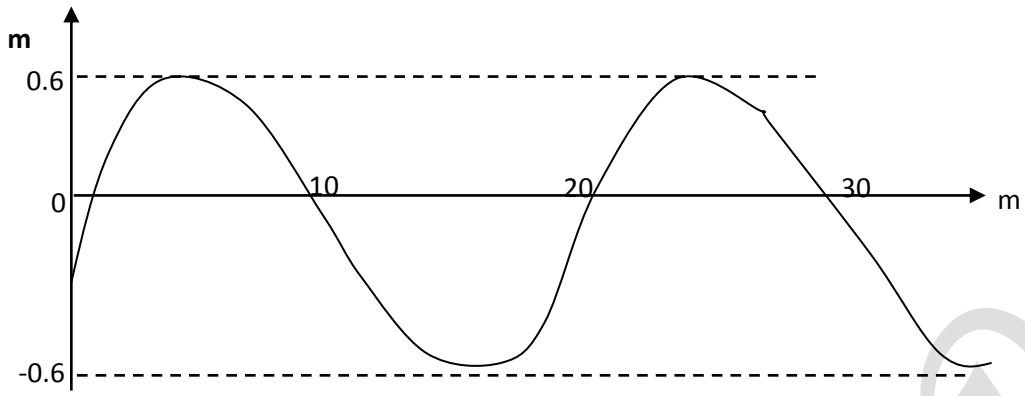
72. The diagram below shows a display of a sound wave.



(a) Which graph shows a louder sound? [1]
(b) State three(3) properties of a sound waves and explain how each is affected by the change in amplitude, wavelength and frequency [3]
(c) Describe an experiment to show that sound requires a tangible medium for its propagation. [4]
[TOTAL: 8MARKS]

73.(a) Below is a list of examples of waves .state whether each of the following is transverse or longitudinal
(i) Infra-red (ii) sound (iii) radio (iv) light (v) waves in a spiral spring (vi) ripple on water [6]
(b)A certain source produces 279 complete cycles in one second .what is its frequency? [1]
(c)Describe and explain an event which shows that light waves travels faster than sound waves [4]
(d)Describe an experiment you can carry out to determine the speed of sound in air .explain how the equipment would be used And how the final result would be calculated [4]
(e)An echo sounder produces a high pitched sound whose echo is picked up by a hydrophone after 3s .given that the speed of Sound is 1410m/s in water, how deep is the water at this point? [1]
[TOTAL: 16MARKS]

74.(a) the diagram below shows an outline of a water wave



Find

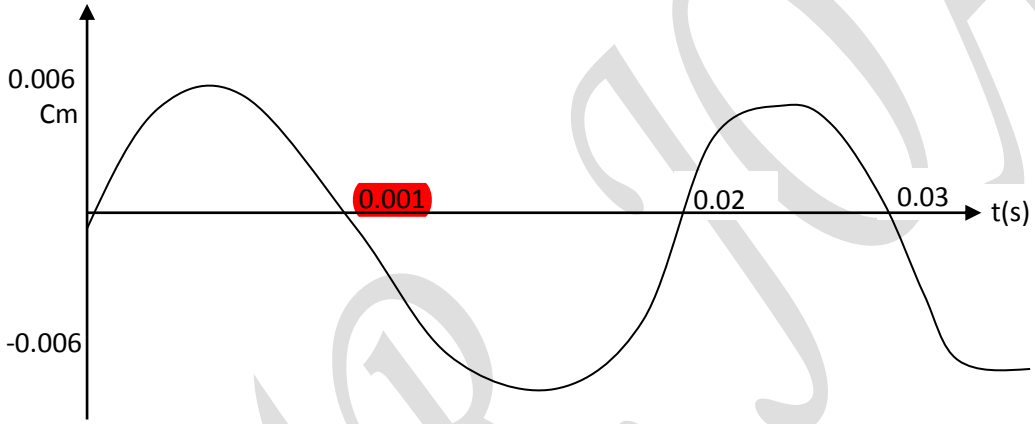
(i) The amplitude [1]

(ii) The wavelength [1]

(b) Echoes produced by a Cliff return in 3s. Taking the speed of sound in air to be 340m/s, calculate the distance from the Cliff.

[TOTAL: 4MARKS]

75. (a)The graph below shows how a particle on the surface of a liquid is displaced by the passage of waves



If the speed of these waves is 2cm/s, calculate

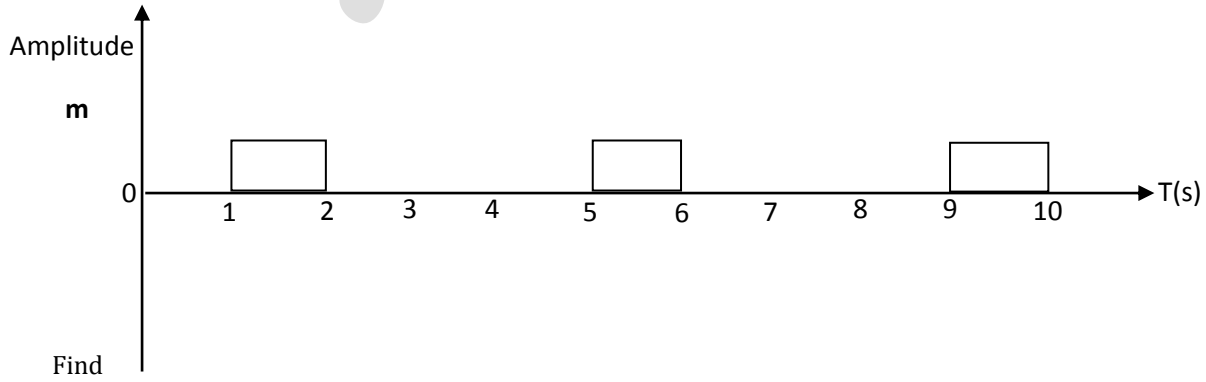
(i) Wavelength cm/s [1]

(ii) Amplitude cm [1]

(b) In determining the depth of the sea below the ship, the ship sends out a sound wave to the sea bed and receives an echo after 1.0s. If the velocity of the sound in sea water is 1450m/s how deep is the water? [2]

[TOTAL: 4MARKS]

76. (a)The diagram below shows a series of pulse waves moving at 3cm/s



Find

(i) Period of the pulse [2]

(ii) Frequency of the pulse [2]

(iii) Wavelength of the pulse [2]

(b) At a certain point 20 waves cross in two minutes time. The troughs are equally speed at 10 cm apart. Calculate

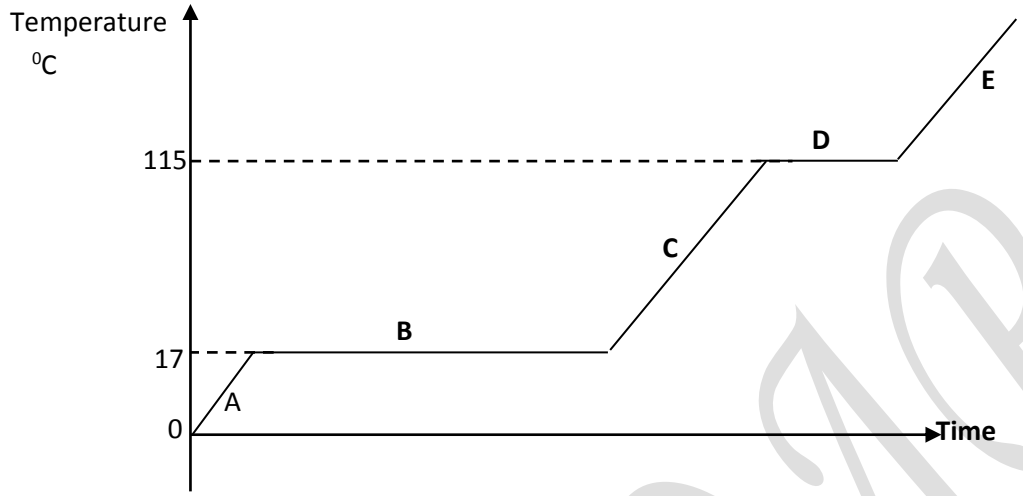
(i) Velocity of the wave [2]

(ii) Time the wave take to travel one wavelength. [2]

[TOTAL: 10MARKS]

GAS LAWS, PRESSURE & BROWNIAN MOTION

77. The graph below is a heating curve for a pure substance. It shows how the temperature rises with, time, when the solid is heated until it melts and then the liquid is heated until it boils.



(a) In what state(s)is the substance at
  (i) A
  (ii) C
  (iii) E [3]

(b) What is the melting point of the substance? [1]

(c) What is its boiling point? [1]

(d) What happens to the temperature when the substance changes to the state? [1]

(e) How can you tell that the substance is not water? [1]

[TOTAL: 7MARKS]

78. (a) Describe the motion of the molecules of a gas . [1]

(b) A bicycle pump of volume 72cm^3 is filled with air at a pressure of 0.100mpa. The volume is reduced To 30cm^3 no air leaks from the pump and the temperature stays constant. Calculate the pressure of The compressed air

(c) State boyles law. [1]

[TOTAL: 4MARKS]

79. When a mixture of smoke and air is suitably illuminated and viewed through a microscope small bright specks are seen to be moving In a jerky random motion.

(a) What are the bright specks? [1]

(b) Why do they move? [1]

(c) What change or changes in the motion of smoke and air would you observe if the mixture were warmed? [1]

[TOTAL: 3MARKS]

80. Use the molecular theory of matter to explain briefly why

(a) A gas exerts a pressure on the walls of its container . [1]

(b) The pressure increase with temperature (assuming that the volume does not change). [1]

(c) The pressure inside a balloon increases when it is squashed. [1]

[TOTAL: 3MARKS]

81.

Volume increases	Volume	Decreases	Volume stays the same
Pressure increases	Pressure	Decreases	Pressure stays the same

Complete the following statements about how gasses behave using one phrase from the above boxes. Each phrase may be used once, more than once or not at all.

(a) When the pressure on a gas increase and its temperature stays the same, its..... [1]

(b) When the temperature of a gas increases and its pressure stays the same its..... [1]

(c) When the..... And the volume stays the same the temperature of a gas decreases. [1]

[TOTAL: 3MARKS]

82. Explain and give a reason what happens when

(a) Pressure of a gas in a closed container if the volume decreases but temperature remains the same. [2]

(b) Volume of a gas in a closed container if the temperature increases, but the pressure remains the same [2]

(c) Temperature of a gas in a closed container if the pressure decreases but the volume stays the same [2]

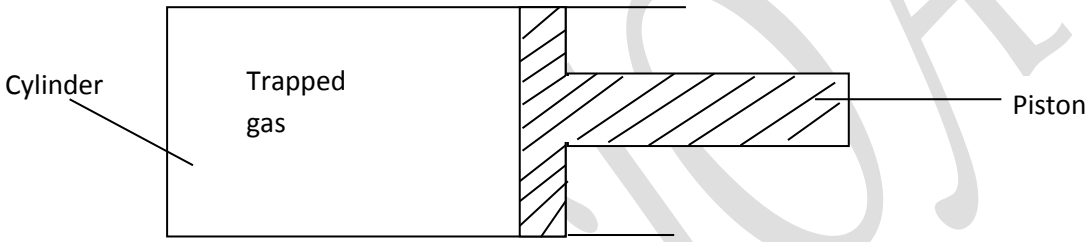
(d) Volume of a gas in a closed container if the pressure decreases but the temperature remains the same. [2]

(e) Pressure of a gas in a closed container if the speed of the gas increase, but the volume and numbers of gas particles remains the same. [2]

(f) Pressure of a gas in a closed container if the new gas that has more massive particles, but maintains the same number and speed of gas particles as the original? [2]

[TOTAL: 12MARKS]

83. The cylinder shown contains a gas .the piston is held fixed and the cylinder is heated



(a) After some time the pressure of the trapped gas increase .Explain why the pressure increased. [1]

(b) Before the cylinder was heated the gas still exerted the pressure on the walls of the cylinder. Explain what caused gas pressure in the first place. [1]

(c) A given mass of air occupies $12m^3$ at normal atmospheric pressure. If the pressure is increase to 4 times the original value in without changing the temperature, what volume will the air occupy? [1]

[TOTALs: 3MARKS]

84. (a) What is meant by the term pressure? [1]

(b) Complete the table below on the relation of pressure and area.

Pressure	Area
Increase	
	Increases

[2]

(c) The wind pressure on the wall is 100Pa,if the wall has an area of $6m^2$,what is the force on it? [1]

.(d) A force of 200N acts on an area of $4m^2$ .assuming that g=10N/kg, and that all forces are acting at right any less to any area Mentioned.

(i) What pressure is produced? [1]

(ii) What would the pressure be if the same force acted on half the area? [1]

(e) What force is produced if

(i) A pressure of 1000Pa acts on an area of $0.2m^2$? [1]

(ii)A pressure of 210Pa acts on an area of $0.2m^2$? [1]

(f)(i)Explain why a tractor's big tyres stop it sinking too far into soft soil.

(ii) A concrete block has a mass of 2600kg .if the block measures 0.5m by 1.0m by 2.0m, when resting on the ground?

(g = 10N/kg),What is the pressure? [1]

(iii) A rectangular block of mass 30kg measures *l*= 0.1 m by *b*= 0.4m by *h* =1.5m

Find the rectangular block's area and calculate its weight. [2]

.(g)(i) On a frozen lake, the ice will break if the pressure on it is greater than 1.0N/cm^3.Four boys stand on the ice, which one will fall through.

	Weight of boy	Area of feet
A	200N	270cm^2
B	300N	250cm^2
C	400N	500cm^2
D	500N	560cm^2

Explain your answer,

(ii)A crate weighing 1000N rest on the floor its base measures 0.5m by 0.2m.Calculate the pressure acting on the floor.

(iii)A gas in a cylinder is exerting a pressure of 400Pa on the walls. If the walls have an area of 3m^2.

Calculate the total outward thrust on them.

(iv)The pressure in a car's tyre is 200kpa.The total weight of the car is 10,000N.Calculate the area of the car's tyres which must be in Contact with the ground [5]

85. State whether the following statements describe a solid, liquid and a gas.

(a)Particles move about freely at high speed. [1]

(b)Particles vibrate and cannot change position. [1]

(c)Fixed shape and volume. [1]

(d)Particles vibrate but can change positions. [1]

(e)No fixed shape or volume. [1]

(f)Fixed volume but no fixed shape. [1]

(g) Virtually no attractions between particles. [1]

86. The three states of matter are solid, liquid and gas.

(a) In the boxes below, by drawing show the arrangement of particles.

Solid

Liquid

Gas

(b)In the boxes below draw inthem to show the arrangement of molecules in water at different temperatures. [3]

-20^{0}C

112^{O}C

22^{O}C

(c)Give two physical properties of a

(i) solid (ii) liquid (iii) Gas [6]

[TOTAL: 2MARKS]

87. (a)Define the term temperature. [1]

(b)Convert the following temperatures to Kelvin's.

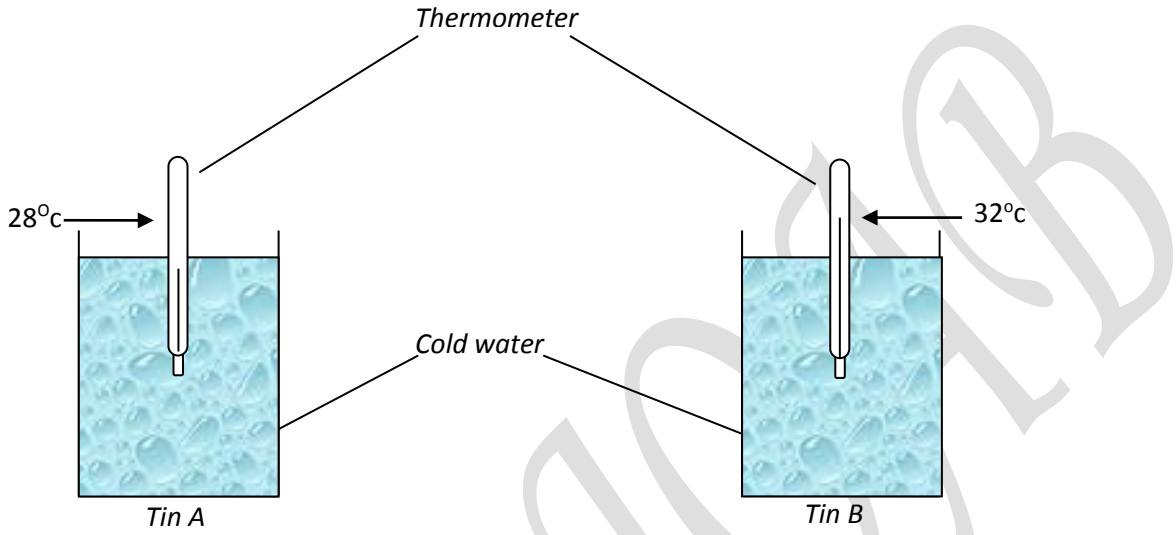
(i)-273^{0}c (ii)0^{0}c (iii)110^{0}c (iv)-28^{0}c. [4]

(c)convert the following Kelvin to degree Celsius

(i)27K (ii)111K (iii)100K [3]

(d)Name an instrument which is used to measure human body temperature. [1]

88.Below are two identical tins A and B .one is with a silvery shiny surface and the other one with a black painted surface. A thermometer was placed in each tin and they were placed into strong sunlight.



(a) State the name of the process that transferred the energy to the tins. [1]

(b)(i) Which tin A or B is with the silvery shiny surface. [1]

(ii)give a reason for your answer in B(I) above. [1]

(c) What conclusion can you draw from the behaviour of a silvery shiny and a black painted objects? [2]

(d) Describe an experiment you can carry out to show that black surfaces are good absorbers of radiant heat than polished surfaces.

89. (a) Most good quality source pans are often made with a copper base and plastic handle. Explain why this is done. [2]

(b) Explain why an immersion heater would boil water more quickly in a plastic, rather than a metal cup. [2]

(c) Explain why the heating element in an electric kettle is rear the bottom. [1]

(d) Heat loss from a pan is reduced when it is fitted with a lid. Explain. [2]

90. (a) Which process of heat transfer transfers thermal energy in

(i) Solid

(ii) Gasses

(iii) Water

(iv) Alcohol

(v) Copper wires [5]

(b) Explain how heat is transferred by

(i) Conduction (ii) Convection (iii) Radiation [6]

91. Two metal bars of same size, made out of copper and iron respectively, were placed so that one end of each was in the flame of a

Bunsen banner.

Explain the following observations..

(a) After a while, the end of the iron bar glows red but the end of the copper rod does not glow. [2]

(b) The experimenter tried to remove the rods from the flame. He burnt himself on the copper rod but not on the iron rod. [2]

(c) Describe an experiment to show that dark surfaces are better emitters of heat radiation than polished materials. [5]

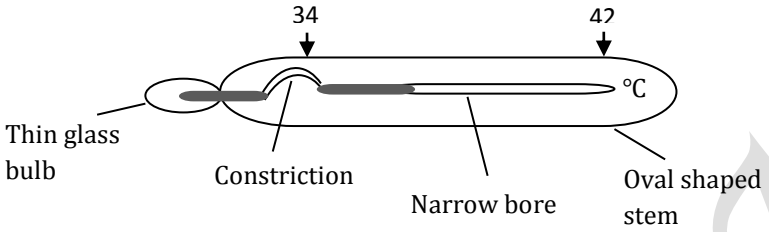
92. (a) Explain the following

(i) Lower fixed point [2]

(ii) Upper fixed point [2]

(a) Draw a diagram to help you describe how you can check the lower fixed point of pure ice. [3]

93. (i) A thermometer is a device used measure temperature. Below is a diagram showing a chemical thermometer.



Explain why the thermometer has;

(a) A narrow bore [1]

(b) A thin glass bulb [1]

(c) A constriction [1]

(d) A short range of temperature [1]

(e) A oval shaped glass stem [1]

(f) A magnifying bulb along the stem [1]

(g) A contrasting white background [1]

(ii) Give two advantages that a thermocouple thermometer has over a mercury thermometer. [2]

(iii) Explain how a clinical thermometer can be used to measure temperature of a patient, include any precautions you would take to ensure both hygiene and accuracy. [3]

94. (a) Describe an experiment to show that copper is a better conductor of heat than iron. [5]

(b) Describe an experiment to show that water is a poor conductor of heat. [3]

(c) (i) Give two similarities between evaporation and boiling. [2]

(ii) Differentiate evaporation from boiling [2]

95. Describe an experiment you would carry out to determine the refractive index of glass,given a rectangular glass block.draw a diagram to show what measurements you would have to make,and how the result would be calculated [7]

96. A glass bottle was heated. State whether the following properties were unchanged, decreased or increased.

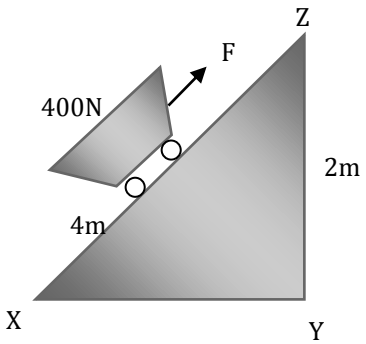
(a) Mass of the bottle [1]

(b) Density of the bottle [1]

(c) External diameter of the bottle [1]

(d) Volume inside the bottle [1]

97. The trolley below weighs 400N.



(i) Find the work done if the trolley was lifted vertically from point Y to Z. [1]

(ii) What force F is needed to pull up the ramp from X to Z, assuming that there is no friction [1]

98. (a) Define the following terms.

(i) Mechanical advantage [1]

(ii) Velocity ratio [1]

(iii) Efficiency of a machine [1]

(b) A machine with a velocity ratio of 6 requires 800J of work to raise a load of 60kg through the vertical height of 100cm

Calculate

(i) The weight of the load [1]

(ii) Its efficiency [2]

(iii) The mechanical advantage [1]

99. (a) What do you understand by;

(i) Energy output (ii) Energy input of a machine [2]

(b) A crane in Nchanga Open Pit uses 20000J of energy to lift copper concentrate of mass 2200kg through a vertical height of 600cm. Take g=10N/kg.

Calculate

(i) Work done by the crane on the copper concentrate [1]

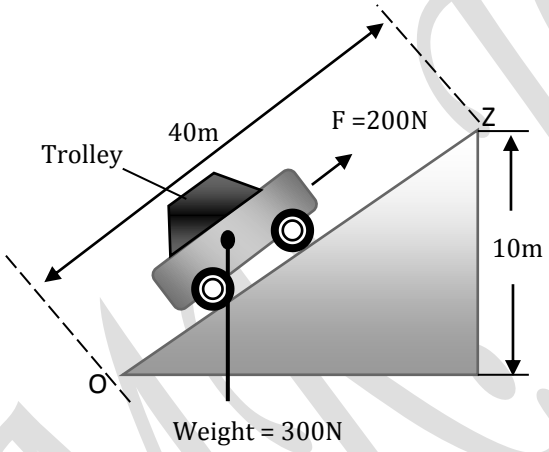
(ii) Efficiency of the crane [1]

(c)Explain why the energy output of the crane would be less than the input energy. [1]

100.(a) Define the following terms.

(i) Effort (ii) load [2]

(b) A trolley is being pulled up a ramp from point 0 to Z by exerting a force of 200N as shown in the figure below.



Calculate

(i) Work done against gravity when the trolley reaches Z. [1]

(ii) Mechanical advantage of the system [1]

(iii) Velocity ratio of the system [1]

(iv) The input energy of the system [1]

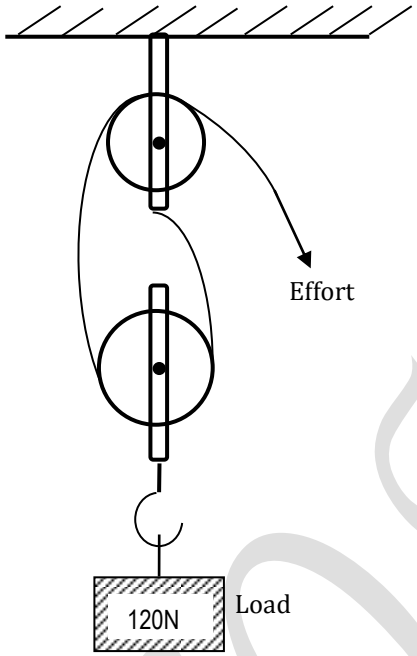
(v) The efficiency of the system [1]

(vi) Mass of the trolley [1]

101. (a) Draw a pulley system with velocity ratio of

(i) 4 (ii) 6 [4]

(b) The pulley system below is used to lift a weight of 120N from the first floor to the second floor of the ware house at Bwafwano House



(i) What is the velocity ratio of the pulley system above? [1]

(ii) If the efficiency of this system is 75%, Calculate the mechanical advantage of the system. [1]

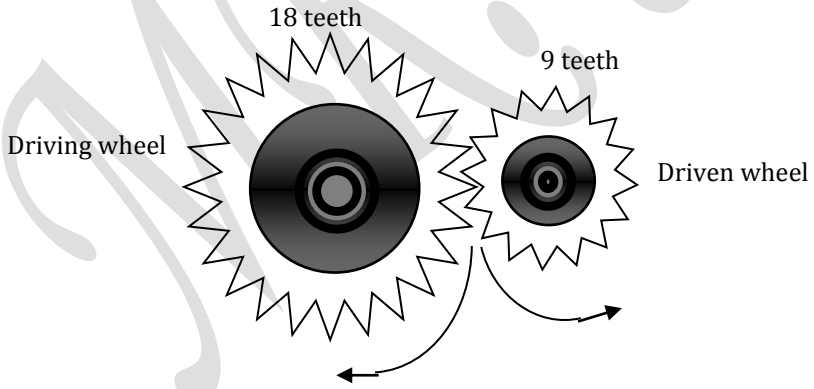
(iii) Find the size of the effort that lifted the load. [2]

(iv) What work is done by the effort if the load is lifted by 0.5m? [2]

(v) How much energy is wasted during this operation? [2]

(vi) Explain why the efficiency of the pulley is not 100% [1]

102. The diagram below shows the gear-wheel system.



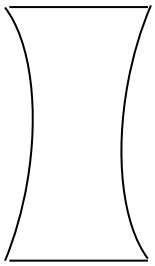
From the figure above, calculate

(a) The velocity ratio (V.R) [2]

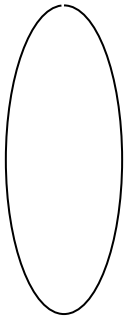
(b) The mechanical advantage of the system if its efficiency is 80%. [2]

(c) If the driven wheel makes 11 rotations, how many rotations would the driving wheel make? [3]

103. Below are two types of lenses



Diverging lens



Converging lens

State which type of a lens should be used for each of the following.

(i) Correction of long sight. [1]

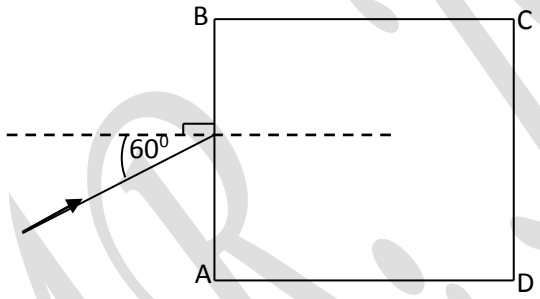
(Ii) A magnifying glass. [1]

(iii)a camera [1]

(iv) Projecting a large, real image. [1]

(v)to produce a pure spectrum with a triangular prism. [1]

104. The figure bellow shows a square block of glass ABCD with a ray of light incident on side AB at an of incident of 60^0 the refraction index of the glass is 1.5.



(a)Define

(i)Refraction [1]

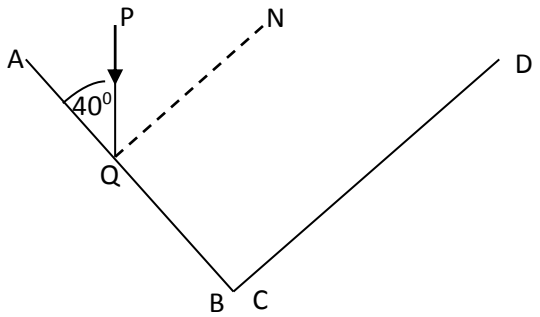
(ii)Refractive index. [1]

(b)Calculate the angle of refraction of the ray. [2]

(c)Complete the diagram to show the movement of a ray of light through and out of the block. [2]

(d)Explain why the ray shown cannot emerge from side BC but will emerge from the side indicated in your answer in (c). [2]

105.The figure below shows a ray of light PQ striking a mirror AB .The mirror AB and the mirror CD are at right angles to each other. QN is the normal to the mirror AB.



(a)(i)Define reflection [1]

(ii)State thee two laws of reflection [2]

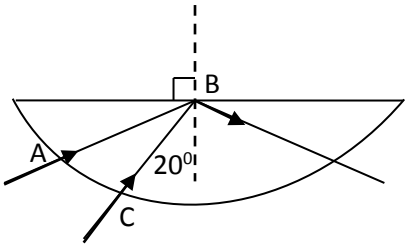
(b)(i)What is the value of the angle of incidence of the ray PQ on the mirror AB? [1]

(II)Complete the diagram to show how the ray of PQ will continue in its path after reflection at both mirrors. [2]

(iii)Mark on your diagram the value of the angle of reflection on AB ,the angle of incidence on CD and the angle of reflection on CD. [3]

(iv)What do you notice about the final reflected ray? [1]

106.The figure below shows rays of light in a semicircular glass block.



(a)Explain why the ray entering at A is not bent. [1]

(b)Explain why the ray AB is reflected at B and not refracted. [2]

(c)Ray CD does not stop at B. Copy the diagram and draw its approximate path after it leaves B. [2]

107.(a)With the help of suitable labelled diagrams explain what is meant by:

(i)Refraction [2]

(ii)Refraction index [2]

(iii)Critical angle [2]

(iv)Total internal reflection [2]

(b)Draw diagram to show how a 45^0,45^0,90^0 prism can be used

(i)To turn a ray of light through 90^0 . [2]

(ii)To turn a ray of light through 180^0 . [2]

108.Below are lenses A and B.

(a)Which of the lenses above is a convex? [1]

(b)Which one is a converging lens? [1]

(c)Define the following

(i)Principal focus (focal point). [1]

(ii)focal length [1]

(iii)Principal axis [1]

(d)Name one piece of equipment which uses

(i) Converging lens to produce a real and enlarged image. [1]
(ii)Converging lens to produce a real image which is usually smaller than the object. [1]

109.(a)An object 2cm high stands on the principal axis at a distance of 9cm from a convex lens. if the focal length of the lens is 6cm ,what is the

(i)images position [1]
(ii)height [1]
(iii)type [1]

(b)An object 2cm high is placed 2cm away from a converx lens of focal length 6cm.By doing an accurate drawing on a graph paper, find the position ,height and type of image. [9]

110. (a)With the aid of a diagram explain what is meant by focal length and principal focus for

(i)a thin converging lens. [2]
(ii)a thin diverging lens. [2]

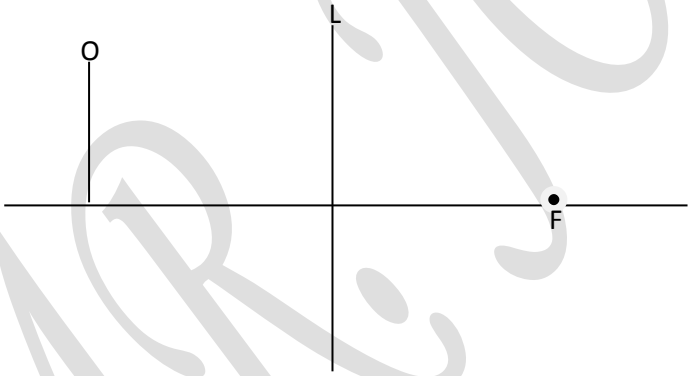
(b)Describe how would measure the focal length of a thin converging lens using a suitable distant object. [3]

(c)A thin converging lens being used as a magnifying glass produces a virtual image 24cm from the lens. The height of the image is three times that of the object. Using graphical method,

Find

(i)the distance of the object from the lens. [2]
(ii)the focal length of the lens. [2]

111. (a)The diagram below is showing an object standing in front of a thin converging lens L.F is the focal point of the lens.



Draw a ray diagram to show the formation of the image I. [4]

(b) Suggest whether the image is

(i) Real or virtual [1]
(ii) Magnified or diminished [1]
(iii) Upright or virtual [1]

(c)What is meant by

(i) Virtual image [1]
(ii) Real image [1]

(d)A thin converging lens can be used to produce either a virtual or real image .Explain the difference between these types of images.

Draw two ray diagrams, one to show the formation of a real image, the other to show the formation of a virtual image, using a Converging lens. [8]

STATIC AND CURRENT ELECTRICITY

112. A current of 4A flows from a battery when a light bulb is connected across its terminals. The P.d across the terminals is 12V

(a) What quantity of charge flows in 1 second? [1]

(b) How much energy does each coulomb leaving the battery posses [1]

(c) How much charge must be given out by the battery if it is to supply 60J of energy? [1]

(d)How long does the battery take to supply 60J of energy? [1]

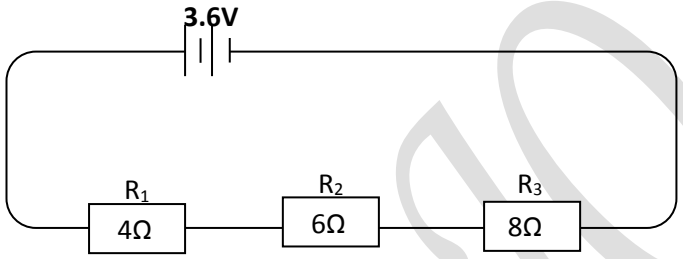
113. (a) State the equation connecting voltage, current and resistance. [1]

(b) (i) A current of 2A flows through a conductor. The conductor has a voltage of 12V across it. Find the resistance of the conductor. [1]

(ii) How much current will flow through a 10Ω resistor if a voltage of 50V is applied? [1]

(iii) An electric bell has a resistance of 4Ω.When it rings the current through it is 3.0A.What voltage must be used to operate the bell [1]

114. The below shows the 4Ω,6Ω and the 8Ω resistors connected in series with a 3.6V battery.



(a) calculate the effective resistance [1]

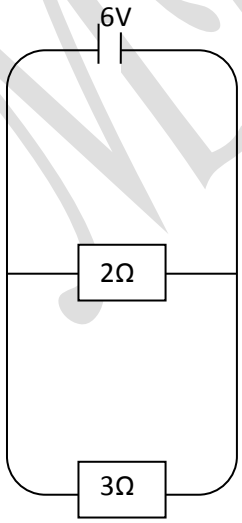
(b) calculate the current delivered by a battery [1]

(c) calculate the voltage cross the

(i) 4Ω (ii) 6Ω (iii) 8Ω [3]

(d) calculate the voltage across the three resistors. [2]

115. The diagram below shows a parallel circuit .



(a) Find the

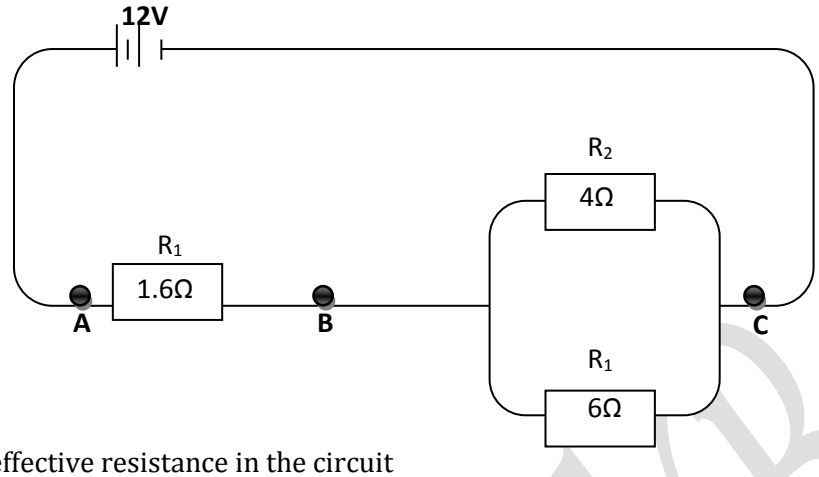
(i) Total resistance [2]

(ii) Current through the 2Ω resistance [1]

(iii) Current through the 3Ω resistor. [1]

(b) Explain the advantage of parallel connection over series connection [2]

116. The diagram below shows the combined connection of the resistors



(a) calculate the effective resistance in the circuit [1]
(b) calculate the main current delivered by a battery [1]
(c) calculate the voltage across (i) AB (ii) BC [2]
(d) calculate the charge through the 1.6Ω resistor in 1 minute [2]
(e)calculate the current through the (i) 4Ω (ii) 6Ω resistor [2]

117. An electric kettle is marked 240V ,100W.
(a) what is the meaning of the statement above? [1]
(b)calculate the current which is drawn by the kettle when it operates normally. [1]
(c) calculate the resistance offered by the heating element. [1]

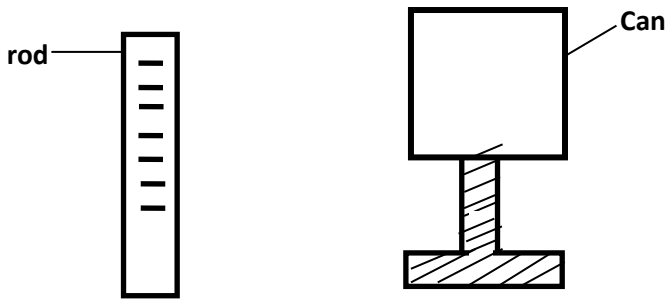
118. An electric heater is marked 240V ,2kw
(a) what is the meaning of this label? [1]
(b) calculate the current drawn by the heater .When it operates normally [1]
(c) calculate the number of electricity used by the heater when it operates for 8 hours [1]

119. A light bulb is marked 12V,3A .
(a) what is the power offered by the light bulb ? [1]
(b) calculate the resistance offered by the filament [1]

120. Four security lights of 120W are turned on for 30days .What is the energy cost if it costs k60 per unit? [2]

121. Explain why
(i) A fuse is included in the circuit and what happens when the fuse blows
(ii) The metal casing of the heater is connected to the earth [1]
(iii) The electrical power input to the bucket is 2000W and the bucket is switched on for 6 minutes .
Calculate the electrical energy in joules supplied to the bucket. [2]
(iv) State the function of the earth wire? [1]

122. On the diagram below a charged rod is held close to a metal can .The can is on an insulated stand.



(a) Draw in, any induced charges on the can [1]
(b) Why is the can attracted to the rod even though the net (overall) charge on the can is zero [1]
(c) If you touch the can with your finger ,electrons flows through it .In which direction is the flow [1]
(d) What type of charge is left on the can after it has been touched? [1]

123. The figure below shows two spheres A and B being charged by induction using a negatively charged rod brought near A. In figure 2,the two spheres are separate, in figure 3 ,the charge rod is removed.

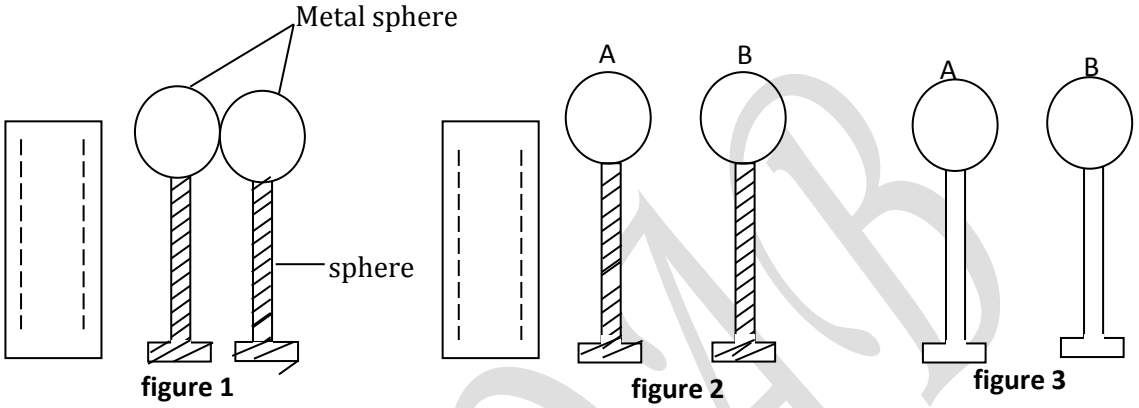
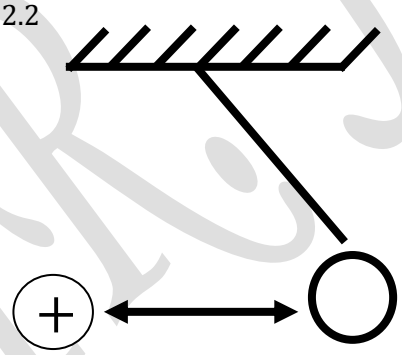


figure 1 figure 2 figure 3

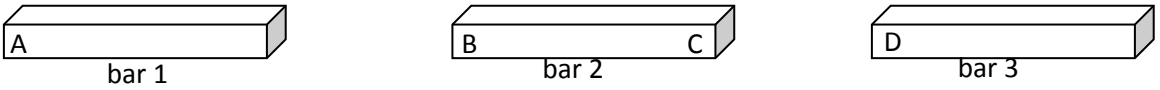
(i) What should be the nature of the material used as the support of each sphere? [1]
(ii) On each sphere in figure 1,2 and 3 indicate the charge distribution [3]

124. (a) State three applications of electrostatics in real life [3]
(b) An electrically charged sphere C is brought near a small uncharged conducting sphere S suspended as shown in
Figure 2.1.S is first attracted towards C until it touches the surface of C and then repelled to the position shown In figure 2.2



(i) (a) Explain carefully why S is first attracted towards C [1]
(b) Explain why S is repelled after touching the surface of C [1]
(ii) when a Bunsen flame is passed beneath S ,the sphere falls back towards C. Suggest why this happen. [1]

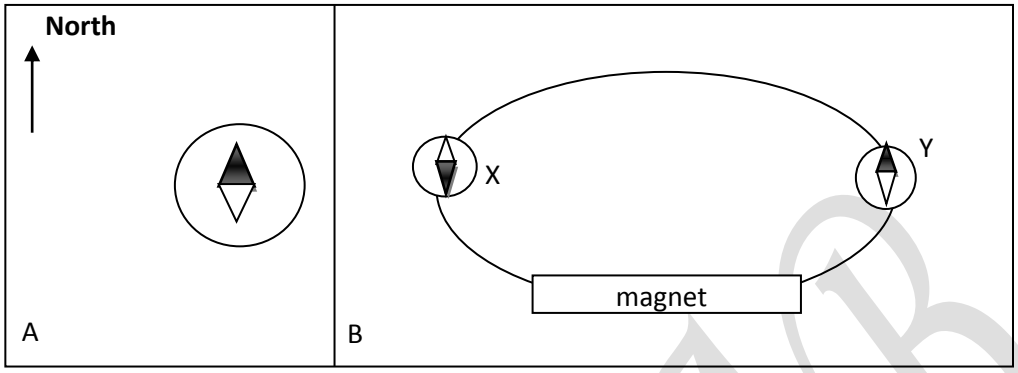
125. The diagrams below shows three metal bars. When different ends are brought together, it is found that A and B attract, and A and C attract ,but A and D repel.



(a) Decide whether each of the bars is a permanent magnet or not [3]

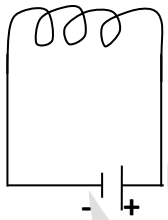
(b) (i) Name three ferromagnetic materials [3]
(ii) Name three non-magnetic materials. [3]
(c) What is meant by the south pole of a magnet?

126. In the diagrams below, the same compass is being used in both cases.



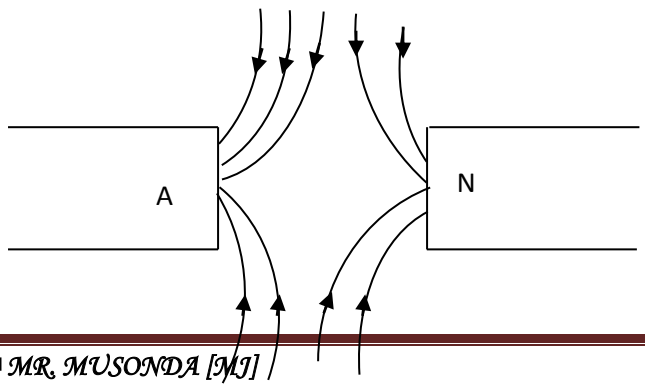
(a) On diagram A label the S and N ends of the compass needle [1]
(b) On diagram B mark in the poles of the magnet to show which is N and which is S .Then draw an arrowhead on the field line to show its direction [2]
(c) In diagram B ,at which position X or Y would you expect the magnetic field to be stronger? [1]
(d) Describe how you can use a plotting compass to draw the magnetic field lines around a bar Magnet [5]

127. The coil in the diagram below is producing a magnetic field



(a) Give two ways in which the strength of the filed could be increased [2]
(b) How could the direction of the field be reversed [1]
(c) Copy the diagram .Show the conventional current direction and the N and S poles of the Coil [2]
(d) Complete the diagram below by drawing the field lines [2]

(e) The diagram below shows the two end poles of the two bar magnets with one end labeled N and the other A

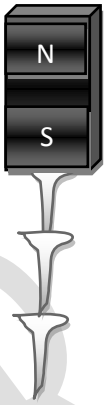


(i) Identify pole labelled A [1]
(ii) Redraw the field lines if both ends of the magnets are south poles. Include arrow heads to show the direction of the field [2]

128. An electromagnetic has a core
(a) What is the purpose of the core ? [1]
(b) Explain why iron is used as a better material for the core than steel [1]
(c) Write down ways of increasing the strength of an electromagnet [2]

129. Current can be used to magnetize a steel bar and demagnetize a bar magnet.
(a) Mention three other methods of demagnetizing a bar magnet apart from using current [3]
(b) Mention another method of magnetization apart from electrical method. [1]
(c) Describe how you can use electric current to
(i) Magnetize a steel bar [4]
(ii) Demagnetize a bar magnet. Diagrams should be included [4]
(d) Explain why
(i) Alternating current is used to demagnetize bar magnets [1]
(ii) Direct current is used to magnetize steel bar [1]

130. (a) In terms of magnetic induction explain why a permanent magnet can hold three iron nails as shown below [2]

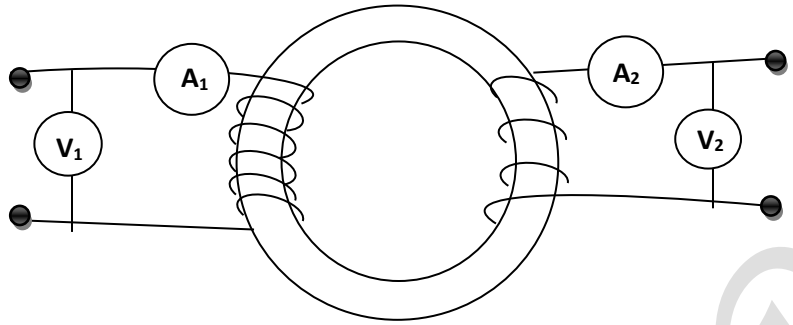


(b) Giving good reasons, explain which one, iron or steel can be used in making
(i) Permanent magnet [1]
(ii) Magnetic relay coil [1]
(iii) Core of an electromagnet [1]
(iv) Core of a moving coil meter [1]
(v) Magnetic shield screen [1]
(c) Differentiate the magnetic properties of iron from those of steel [2]

131. Describe an experiment to show
(a) That a magnet has two different types of poles (S & N) [3]
(b) That a magnet can act as a compass. [3]
(c) Magnetic properties are concentrated at the poles [3]
(d) A magnet is surrounded by a magnetic field. [3]

132. (a) Name two types of transformers [2]

(b) In the figure below A_1 , = 0.15,V_1, = 2.4 ,and A_2 = 0.2



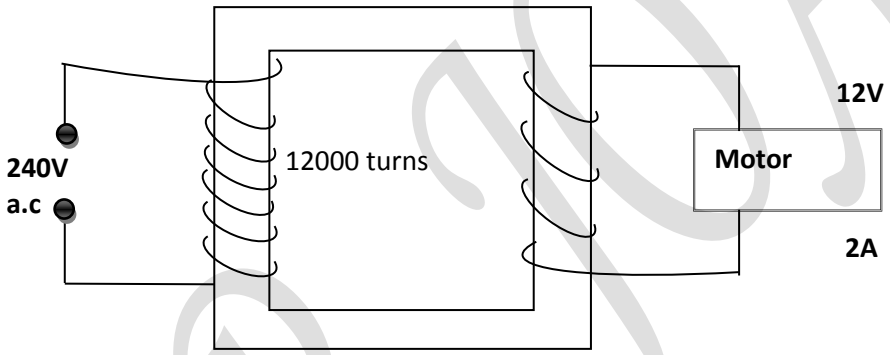
(i) Find the value of V_2 . [1]

(ii) Calculate the power output [1]

(iii) What type of a transformer is this? Give a reason for your answer [2]

(c) Describe the principle operation of a transformer [4]

133. The diagram below represents a step down transformer used to supply an electric motor rated at 12V,2A



(a) Calculate the number of turns on the secondary coil [1]

(b) Assuming the transformer to be 100% efficient, calculate the size of the current in the primary coil [1]

(c) (i) Which coil .primary or secondary ,should have the thicker wire? [1]

(ii) Explain your answer to C (i) [1]

(d) Describe the structure of a transformer that reduces voltage [4]

134. (a) A step down transformer gives a current of 5A of 12V.If the primary voltage is 240V,find

(i) The primary current [1]

(ii) The power input [1]

(ii) The power output, assuming no power losses [1]

(b) Describe the structure of a transformer that increases voltage [4]

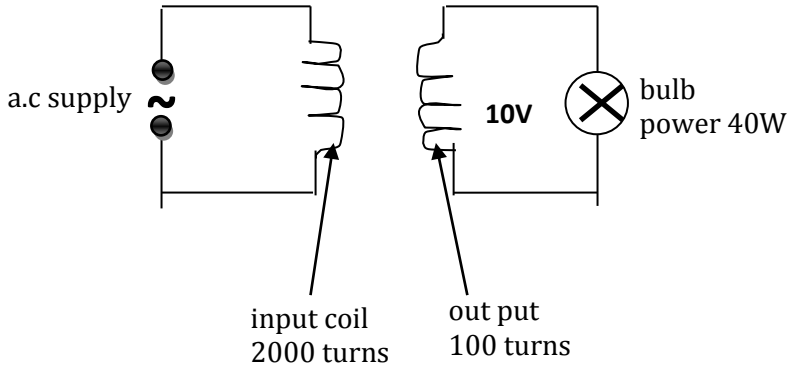
(c) Explain why

(i) The core of the transformer is made of a soft iron [1]

(ii) The coil is made of copper wire [1]

(d) Explain how the power loss through eddy currents in a transformer is minimized [1]

135. Assuming that, the transformer below has an efficiency of 100%



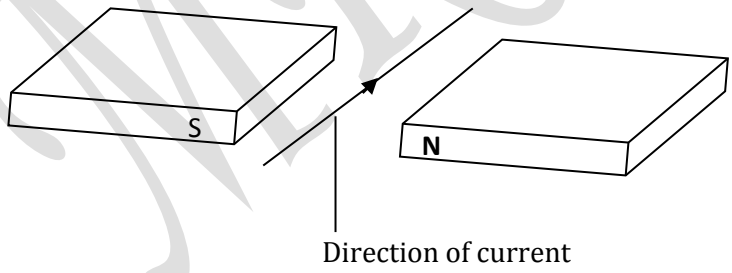
(a) Calculate the supply voltage [1]
(b) Calculate the current through the input [1]
(c) What is meant by ideal transformer? [1]

136. A transformer that has a primary coil with 100 turns and a secondary coil 250 turns. The primary voltage is 12V.
(a) What type of a transformer is this? [1]
(b) What voltage would be obtained from it [1]
(c) Explain how step -up transformer differs from a step-down transformer [2]

137. Explain each of the following
(a) A transformer will not work on direct current [1]
(b) The core of a transformer needs to be laminated [1]
(c) If a transformer increases voltage, it reduces current [1]

138. (a) With the aid of a labelled diagram, describe the structure of a simple a.c generator, and explain how it works [5]
(b) On the same set of axes, sketch lines to compare the outputs of an a.c generator
(i) At a certain rate of rotation. [1]
(ii) At half that rate. [1]

139. There is a force on the wire in the diagram below.

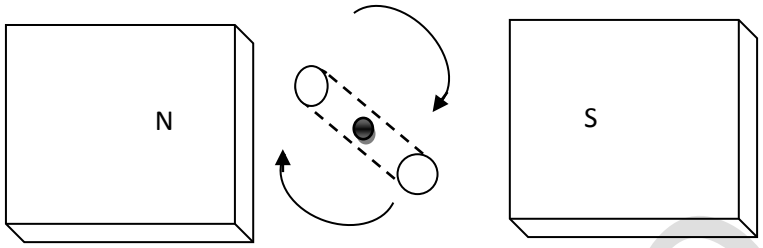


(a) Give two ways in which the force could be increased. [2]
(b) Use Fleming's left- hand rule to work out the direction of the force [1]
(c) Give two ways in which the direction of the force could be reversed [2]

140. An electric motor is used to convert electrical energy to continuous rotational mechanical energy.
(a) Which part(s) of an electric motor?
(i) Connects the power supply to the split- ring and coil. [1]
(ii) Changes the current direction every half - turn? [1]
(b) State the function of the following in an electric motor
(i) Split-ring (Commutator) [1]

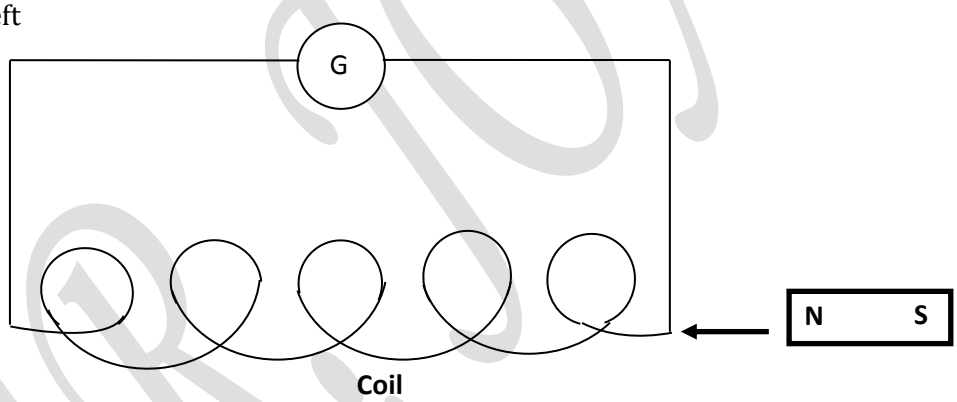
(ii) Brushes. [1]

141. The diagram below shows the end view of the coil in a simple generator .The coil is being rotated. It is connected through brushes and slip rings to an outside circuit.



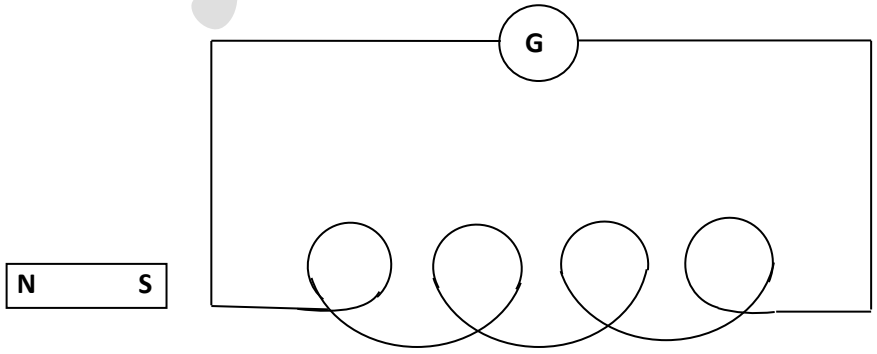
(a) What type of current is generated in the coil, AC or DC? Explain why it is this type of current being generated [2]
(b) Give three ways in which the current could be increased [3]
(c) (i) The current varies as the coil rotates .What is the position of the coil when the current is a maximum? [1]
(ii) Why is the current a maximum in this position [1]

142. The diagram below shows a permanent magnet being moved toward a coil whose ends are connected to a Galvanometer. As the magnet approaches, the galvanometer needle gives a small deflection to the left



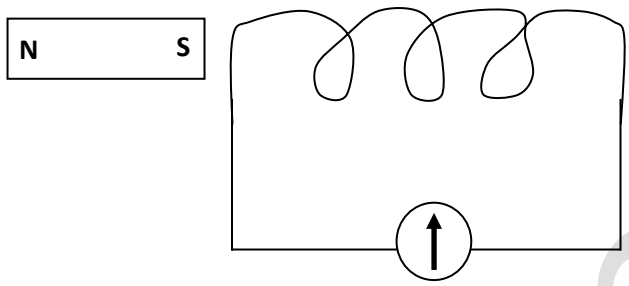
(a) State what you would expect the galvanometer needle to show if, in turn
(i) The magnet was pulled away from the coil [1]
(ii) The magnet was reversed so that the South Pole was moved towards the coil. [1]
(iii) The magnet was pulled away from the coil, at a much higher speed. [1]
(b) Give the name of the process which is illustrated by these experiments [1]

143. A student was investigating electromagnetic induction by pushing a magnet into a solenoid, as shown below.



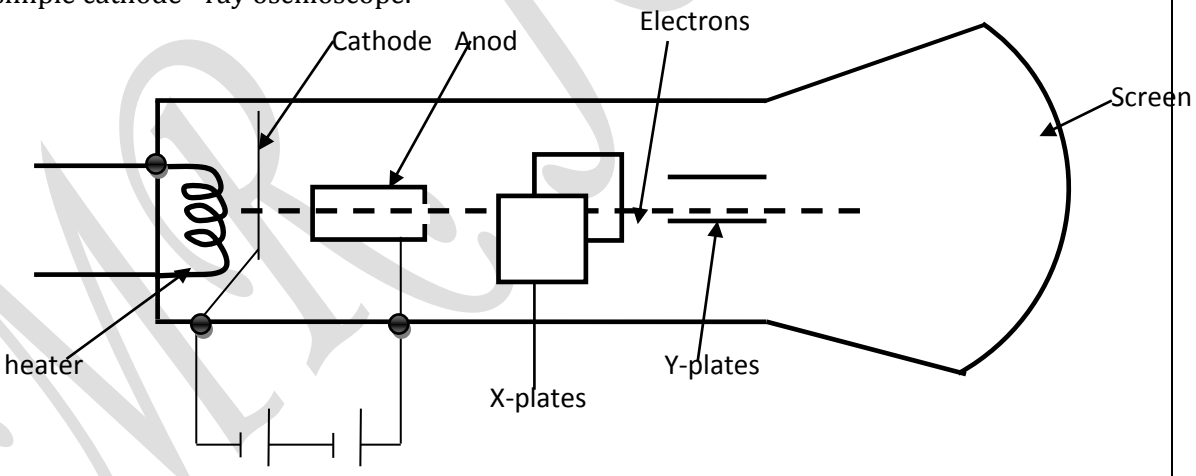
(a) What would have been observed on the centre -zero galvanometer as he?
(i) Was pushing the magnet into the solenoid. [1]
(ii) Held the magnet stationary inside the solenoid. [1]
(iii) Was pulling the magnet out of the solenoid? [1]
(b) He repeated the experiment twice.
(i) Reversing the magnet. [1]
(ii) Using a stronger magnet .What change in observation, compared with (a)(i) above ,would be seen in each Case. [1]

144. In the diagram below, a magnet is being moved towards a coil



(a) As current is induced in the coil, what type of pole is formed at the left end of the coil? Give a reason for your answer [2]
(b) In which direction does the current flow (conventional) through the mater, AB or BA [1]
(c) Define electromagnetic induction [1]

145.Below is a simple cathode - ray oscilloscope.



(a) Explain how the heater is made to produce electrons as shown
(i) What charge do electrons carry [1]
(ii) Explain how the electrons are emitted from the cathode [1]
(iii) Explain why the electrons move towards the anode. [1]
(ii) Give three properties of electrons [3]
(b) (i) Name the process by which electrons are produced in the C.R.O?
(ii) Why is the potential difference between the cathode and anode made very high [1]
(c) Explain the use of
(i) The Y - plates [1]
(ii) the X - plates [1]
(d) (i) Explain why the vacuum is needed in the C.R.O [1]
(ii) Describe the useful energy changes, which takes place on the screen [2]

146. (a) Name three types of radiation [3]

(b) Which of the radiations is considered to be
(i) A proton (ii) An electron (iii) A neutron [3]
(c) Clearly state the effect named in (a) when subjected to a uniform magnetic field [3]

147. (a) Define the following terms
(i) Half life (ii) Radioisotopes (iii) Background radiation [3]
(b) State
(i) Three sources of radioactivity [3]
(ii) Three source of background radiations [3]
(c)Radioactivity is the **random** and or **spontaneous** **disintegration** of the un stable **parent nuclide** to form a stable **daughter Nuclide**.
Explain terms underlined [3]

148. A sample of mass 1000kg has a half life of 2 years.
(a) Calculate the
(i) Number of half lives in 10 years [1]
(ii) Time taken before only $(\frac{1}{64})$g of the sample remains [1]
(iii) Actual mass that remains after 4 years [1]
(b) Draw the decay curve for this sample in a period of 10 years [4]

149. The unstable nucleus of an atom of an element of mass 1000kg has a half life of 6 years.
(a) Name the two particles found in the nucleus of this atom [2]
(b) what is the meaning of the statement above [1]
(c) Explain how the atom of this element would emit a beta particle.
(d) Calculate the fraction of the initial mass of the element that would remain un decayed after 18 year
(e) How long will it be before only $(\frac{1}{16})$g of the mass remains.
(f) Draw a decay curve for this sample in a period of 24 years.

150. The table below shows the activity of the sample in the interval of two days

Time	0	2	4	6	8	10
Activity	100	68	47	32	22	15

(a) Plot the curve of activity against time [4]
(b) From the curve state the expected half life
(c) State one industrial ,agriculture and medical use of radioisotopes [3]

151. (a) Define radioactive decay
(b) What is
(i) An alpha particle
(ii) a beta particle
(iii) a gamma ray [3]
(c) What is the difference between the nuclei of two isotopes of an element ? [1]

152.(a) Name three methods which could be used to detect whether or not a given object is radioactive, in each case
State what would be observed if the substance was radioactive .
(b) A scientist claims that a small radioactive source is emitting α ɣ β radiations..Give an outline description of an experiment which could be carried out to check the claim. What observations would be made during the experiment?

PHYSICAL MEASSUREMENTS

1. (a) micrometer screw gauge
   (b) Micrometer screw gauge
   (c) Vernier calliper
   (d) Micrometer screw gauge
   (e) Measuring tape
   (f) Micrometer screw gauge

---

2. (a) (i) vector quantity is the one with both size (magnitude) and direction.
   (ii) Scalar quantity is the one with only size (magnitude) without direction.
   (b) (i) 1. Velocity
   2. Displacement
   3. Force
   4. Weight
   (ii) 1. Mass
   2. Acceleration
   3. Speed
   4. Distance
   (c) Vector quantity has both magnitude and direction while scalar quantity has only magnitude without direction.

---

3. (a) 0.1mm
   0.01cm
   (a) (i) To record the Vernier reading
   (ii) To record the main reading
   (iii) Measures the internal diameter.
   (iv) Measures the internal diameter.
   (v) Measures the depth of a cavity or a small bottle.
   (c) M.R = 2.6cm

---

4. (a) To adjust the thimble scale.
   (b) A is sleeve scale
   B is thimble scale
   (c) 1. The spindle and the anvil should be cleaned carefully
   2. The scales should be zeroed
   (d) Micrometer screw gauge
   (i) 0.01mm
   (ii) 0.001cm
   (e) (i) 6.5mm
   (ii) 80 × 0.01
   0.8mm
   (f) Sleeve reading plus (+) thimble reading.
   6.5mm + 0.8mm
   7.3mm

---

5. (a) Clean carefully the spindle and the anvil and zero the thimble scale to minimize errors.

Then open the jaws and place the copper wire between the jaws, then gently adjust the thimble using the ratchet until the object is tightly gripped between the anvil and the spindle. Read the main scale on the sleeve before the edge of the thimble.
Then find a marking on the thimble that is in the line with the horizontal line of the main scale and multiply it by the micrometer accuracy *0.01mm.*
Finally add the main scale reading and the thimble scale reading.

(b) Length.

(c) Sleeve scale = $2.0mm$
Thimble scale = $63 \times 0.01mm = 0.63mm$
$\therefore 2.0mm + 0.63mm$
$= \mathbf{2.63mm}$

(d) - Vernier calliper
- Meter rule

(e) Actual reading = micrometer screw gauge reading – zero error.
$= 4.25mm - 0.06mm$
$= \mathbf{4.19mm}$

---

6. (a) Is a small heavy metal bob that is suspended by a thin inextensible string and it is used to measure time.

(b) $P(t) = \frac{t}{n}$
Data
$t = A\ to\ B = 0.2$
$B+C = 0.2$
0.4_s
$P(t) = ?$

$P(t) = \frac{t}{n}$
$= \frac{0.4}{0.5}$
$\boldsymbol{P\ (t)\ = 0.5_s}$

---

7. Length of the pendulum = length of cotton + length of the bob from its centre of mass

$10cm + 2cm \times \frac{1}{2}$
$10cm + 1cm$
$\mathbf{11cm}$

---

8. (a) (i) $P(T) = \frac{t}{n}$
Data
$t = 2.0_s$
$n = \frac{3}{4} = 0.75\ cycles$
$P(T) = ?$

$P(T) = \frac{t}{n}$
$P(T) = \frac{2.05}{0.75}$
$\boldsymbol{P(T) = 2.73_s}$

(ii) $f = \frac{1}{T}$
$f = \frac{1}{2.73}$
$\boldsymbol{f = 0.37Hz}$

(b) Take about five complete oscillations and measure the time taken for five complete oscillations. Divide the time taken by the number of oscillations to get the period using the following formula.

$$P(T) = \frac{t}{n}$$

---

9. $L\ to\ M \quad - \quad 1.28_s$
$M\ to\ Z \quad - \quad x$

Data

$No.\ of\ swings\ from\ L\ to\ M$

$L\ to\ M = \frac{1}{2} = 0.5\ cycles$

$No.\ of\ swings\ from\ M\ to\ Z$

$M\ to\ Z = \frac{1}{4} = 0.25\ cycles$

$L\ to\ M \quad - \quad 1.28_s$
$M\ to\ Z \quad - \quad x$
$0.5 \quad - \quad 1.28_s$
$0.25 \quad - \quad x$
$\frac{0.5x}{0.5} = \frac{0.32}{0.5}$
$x = 0.64_s$
$\therefore \boldsymbol{P(T) = 0.64_s}$
$\boldsymbol{it\ took\ 0.64_s}$

---

10. (a) **Data**

$t = \frac{1}{4} = 0.25_s$
$n = \frac{1}{2} = 0.5\ cycles$
$P(T) = \frac{t}{n}$
$P(T) = \frac{0.25}{0.5}$
$P(T) = 0.5_s$
Then $f = \frac{1}{T}$
$f = \frac{1}{0.5}$
$\boldsymbol{f = 2Hz}$

(b)(i)Decrease (the longer the string the lower the frequency).
(ii)Remain the same (mass does not affect the frequency).
(iii)Increase.

---

11. (i) (a) $7.6cm - 5.0cm$
$\boldsymbol{= 2.6cm}$

(b) $6.8cm - 4.6cm$
$\boldsymbol{= 2.2cm}$

(c) $4.6cm - 3.9cm$
$\boldsymbol{= 0.7cm}$

(d) $1.2cm - 0.1cm$
$\boldsymbol{= 1.1cm}$

(ii) Place the zero mark of the rule on the end of the hard cover book. Then read the mark at the other end of the book by placing the eye vertically above the mark on the scale.

12. (a) Mass is the amount of matter contained in a substance

(b)

Data
Mass of empty beaker = $30g$
Mass of empty beaker and paraffin = $38.5g$
Mass of paraffin = ?

Mass of paraffin = mass of empty beaker and paraffin – mass of empty beaker
$= 38.5g - 30g$
$= \mathbf{8.5g}$

(c) (i) Mass of liquid = beaker with water - mass of beaker
$= 165g - 85g$
$= \mathbf{80g}$

(ii) Volume of liquid = $= 90cm^3$

(iii) Density $\rho = \frac{m}{v}$
$\rho = \frac{80g}{90cm^3}$
$\boldsymbol{\rho = 0.89g/cm^3}$

(iv) Mass of stone = cylinder with water and stone – cylinder with water
$= 285g - 165g$
$= \mathbf{120g}$

(v) Volume = volume of liquid with stone – volume of liquid
$= 150cm^3 - 90cm^3$
$= \mathbf{60cm^3}$

(iv) $\rho = \frac{m}{v}$
$\rho = \frac{120g}{60cm^3}$
$\boldsymbol{\rho = 2g/cm^3}$

13.

Data
Mass of bottle with air = $53.2g$
Mass of air = $22g$
Mass of empty bottle = ?

Mass of empty bottle = mass of bottle – mass of air
$= 53.2g - 22g$
$= \mathbf{31.2g}$

---

14. (a)(i) Mass does not change while weight changes
(ii) Mass is measured in kilograms (kg) whereas weight is measured in Newton's (N)
(iii) Mass is measured using a beam balance while weight is measured using a spring balance.
(iv) Mass is a measure of inertia while weight is a force.

(b)(i)

Data
Mass = 90kg
g = 10N/kg on earth
w =?

$w = mg$
$w = 90 \times 10$
$\underline{\boldsymbol{w = 900N}}$

(ii) Mass = **<u>90kg</u>**

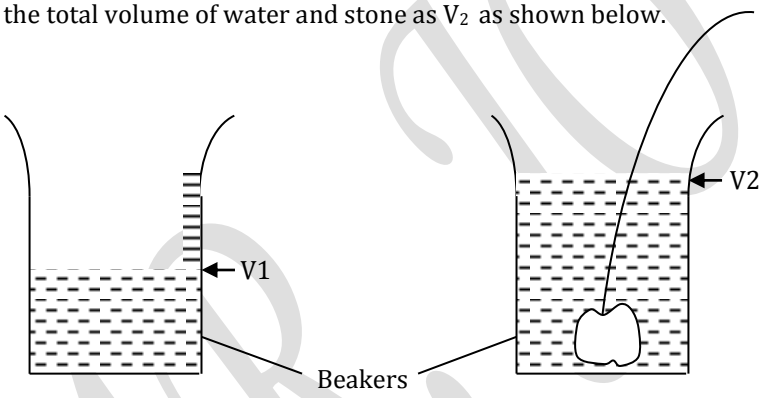
(c)

Data
Mass = 90kg
g = 1.5kg on moon
w =?

$w = mg$
$w = 90 \times 1.5$
$\underline{\boldsymbol{w = 135N}}$

---

15. (a) to determine the density of an irregular object such as stone ,a beam balance ,measuring cylinder and a thin thread is needed. weigh the stone and record its mass as M. pour a measured volume of water in a measuring cylinder and record its volume as V_1 .then gently lower the stone into the water by the aid of a thin string and record the total volume of water and stone as V_2 as shown below.



Then get the volume of the stone by subtracting V_1 from V_2 and calculate the density as shown

$$\rho = \frac{m}{V_2 - V_1}$$

(b)To determine the density of water, an electric beam balance is needed .weigh a clean dry glass beaker using an electronic balance .pour a measured volume of water in a beaker and record the result as follows
Mass of empty beaker =M_1
Mass of beaker + water =M_2
Mass of water alone =M_2-M_1
Volume of water =V

$$Density\ of\ water = \frac{mass\ of\ water}{volume\ of\ water}$$

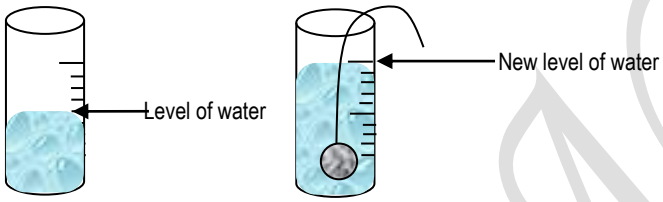
$$\rho(water) = \frac{m}{V}$$

(c) Using a beam balance weigh the mass of a brick and record its mass as M. then using a 100cm rule measure the dimensions of the brick and record them as length (l),breadth (b) and height (h) to get the volume of the brick. Then calculate the density by using the following formula.

$$\rho = \frac{m}{V} \text{ and } V = lbh$$

(d) Fill the graduated cylinder partially with water and cover the sinker into it and then note the level of water and record it as V_1.
Measure the mass of the floater to the object and record it M.
Then tie the floater to the object and gently lower them into the measuring cylinder and record it as V_2 as shown below. The difference in water level will give the volume of the floater and then find its density by using the formula

$$D = \frac{m}{V_2 - V_1}$$



16. (a)

Data
Weight =?
g = 10N/kg
m = 5000kg

$w = mg$
$w = 5000kg \times 10N/kg$
$\underline{\boldsymbol{w = 50,000N}}$

(b) $m = \frac{w}{g}$
$m = \frac{12000\cancel{N}}{10\cancel{N}/kg}$
$\underline{\boldsymbol{m = 1200kg}}$

(c)

Data
W = ?
$m = \frac{200g}{1000g \times kg}$
m = 0.2kg
g = 10N/kg

$w = mg$
$w = 0.2kg \times 10N/kg$
$\underline{\boldsymbol{w = 2.0N}}$

---

17. (a) $Volume = Cross\ section\ area \times length$
$= 0.01 \times 50$
$\underline{\boldsymbol{= 0.5cm}}$

(b) $\rho = \frac{m}{v}$
$\rho = \frac{3.5g}{0.5cm^3}$
$\underline{\boldsymbol{\rho = 7g/cm^3}}$

(c) Micrometer screw guage

---

18. (a) A: because the straight line is slopping upwards showing uniform or constant acceleration.

(b) E: because the straight line is slopping down wards showing uniform (constant) deceleration.
(c) D: because the line is curving down wards showing reducing acceleration.
(d) B: because the line is a horizontal straight line $a = 0m/s^2$
(e) C: because the line curving upwards showing increasing acceleration.
(f) B: because the velocity (speed) is not changing

---

19. (a)

Data
$a = 4m/s^2$
u = 10m/s
t = 8s
v=?

Note: 'at' indicates initial velocity, so don't confuse initial with final velocity, in fact (with) as well as 'from' also indicates initial velocity and only 'to' indicates final velocity.

$a = \frac{V-U}{t}$

$\frac{4}{1} = \frac{v-10}{8}$

$v - 10 = 32$

$v32 + 10$

$\underline{\boldsymbol{v = 42m/s}}$

(b)

Data
x =?
$a = 4m/s^2$
u = 10m/s
t = 8s
v=42m/s

Note: 'How far' is simply distance

$v^2 = u^2 + 2ax$

$(42)^2 = (10)^2 + 2(4)x$

$1764 = 100 + 8x$

$1764 - 100 = 8x$

$\frac{1664}{8} = \frac{8x}{8}$

$x = 208m$

$\underline{\boldsymbol{Distance = 208m}}$

$s = ut + \frac{1}{2}at^2$

$s = 10 \times 8 + \frac{1}{2} \times 4 \times (8)^2$

$s = 80 + \frac{1}{2} \times 256$

$s = 80 + \frac{256}{2}$

$s = 80 + 128$

$\underline{\boldsymbol{s = 208m}}$

---

20. (a) Velocity is the displacement per unity time.

(b) (i)

Data
x =?
t = 8s
v=8m/s

$v = \frac{x}{t}$

$\frac{8}{1} = \frac{x}{8}$

$x = 64$

$\therefore \boldsymbol{Distance = 64m}$

(ii) $v = \frac{x}{t}$

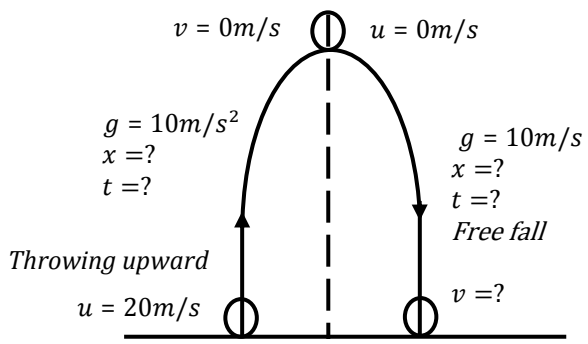
$\frac{8}{1} = \frac{169}{t}$

$\frac{8t}{8} = \frac{169}{8}$

$t = 20s$

$\therefore \boldsymbol{Time = 20m}$

21.



(a) **Key**: consider the upward motion.

Data
$u = 20m/s$
$v = 0m/s$
$g = -10m/s^2$
$x =?$

$v^2 = u^2 + 2ax$
$(0)^2 = (20)^2 + 2(-10)x$
$0 = 400 - 20x$
$\frac{20x}{20} = \frac{400}{20}$
$x = 20$
$\therefore \boldsymbol{Height = 20m}$

(b) **Key**: Consider the upward motion again using the same data in (a)

$v = u + at$
$0 = 20 + (-10)t$
$0 = 20 - 10t$
$\frac{10t}{10} = \frac{20}{10}$
$t = 2s$
It took 2s

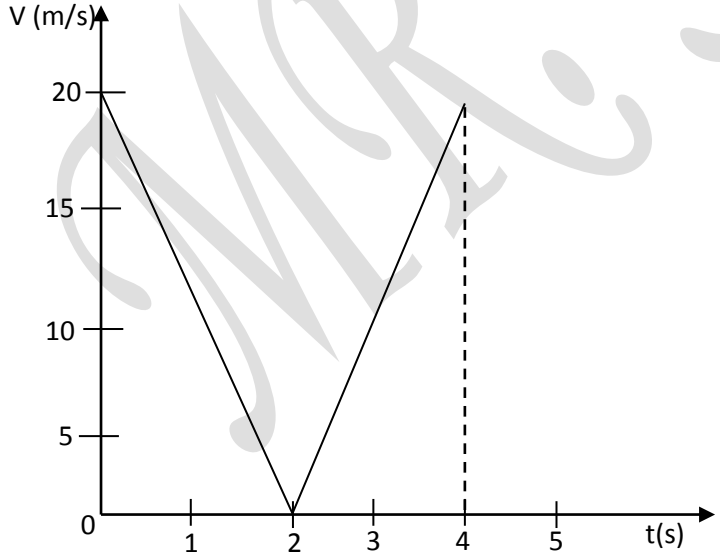
(c)

Data
$v =?$
$u = 20m/s$
$g = -10m/s^2$
$x = 20$

$v^2 = u^2 + 2ax$
$v^2 = (0)^2 + 2(10)(20)$
$v^2 = 0 + 400$
$\sqrt{v^2} = \sqrt{400}$
$\boldsymbol{v = 20m/s}$

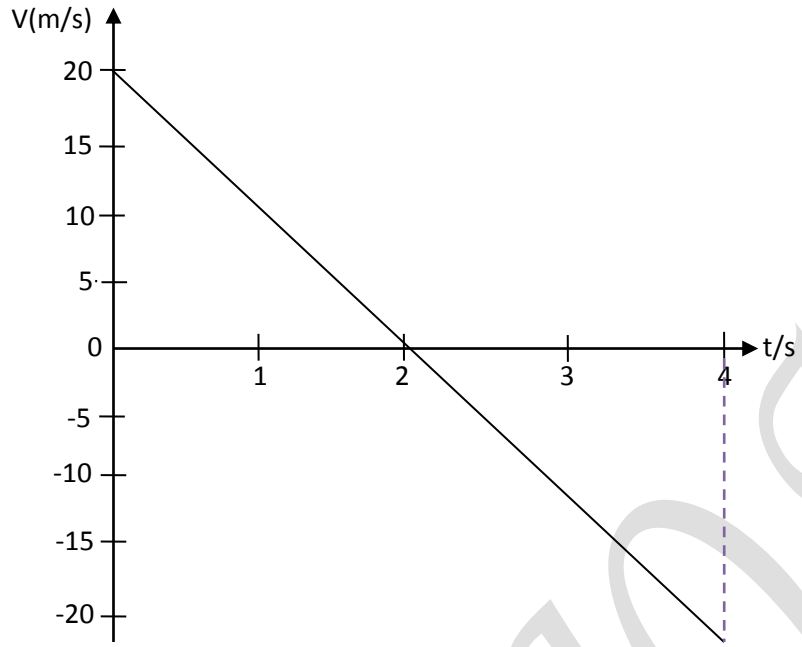
(d) **Key**: Consider the upward and downward motions
Total time = time to go up + time to come down
=2 + 2
= **4s**

(e)(i) Speed time-graph



KEY
for more information
study more on the graphs
on free fall

(iii) Velocity time-graph



22. (a) Maximum speed
Means highest speed
Reached by the motor cycle
∴ Maximum speed = 30m/s

(b)

Data

a =?
$v = 30m/s$
$u = 0m/s$
$t = 10s$

$$a = \frac{v-u}{t}$$
$$a = \frac{30-0}{10}$$
$$a = \frac{30}{10}$$
$$\boldsymbol{a = 3m/s^2}$$

(c) Deceleration is the negative acceleration.

Data

a =?
$v = 0m/s$
$u = 30m/s$
$t = 5s$

$$a = \frac{v-u}{t}$$
$$a = \frac{0-30}{5}$$
$$a = \frac{-30}{5}$$
$$\boldsymbol{a = -6m/s^2}$$

Note: *deceleration does not rest bear a negative the term deceleration means negative acceleration.*

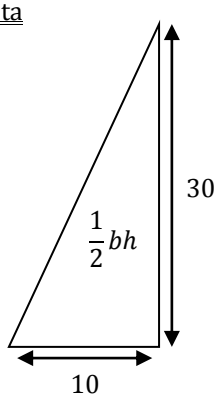
$$\boldsymbol{\therefore deceleration = 6m/s}$$

(d) Note: Distance for a body whose motion is represented in a graph as shown in the question is the area under the given figure.

Therefore: distance equal to Area covered.

(e)

Data



$Area = \frac{1}{2}b\not{h}$

$A = \frac{1}{2} \times 10 \times 30$

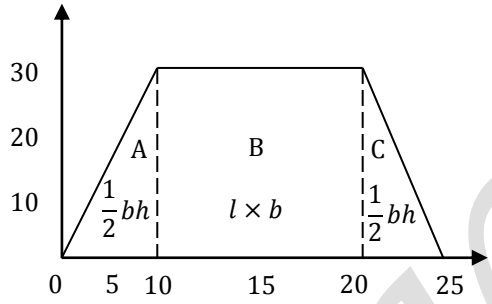
$A = \frac{300}{2}$

$\underline{\boldsymbol{A = 150}}$

***NOTE*: $speed = \frac{distance}{time}$**

$\boldsymbol{S = \frac{d}{t}}$

is not applicable here to find distance.



Distance A

$x = \frac{1}{2}bh$

$x = \frac{1}{2} \times 10 \times 30$

$\underline{\boldsymbol{x = 150m}}$

You can also use the trapezium formula to calculate the distance at once

$A = \frac{1}{2}(a + b)h$

$A = \frac{1}{2}(20 + 25) \times 30$

$A = \frac{1}{2}(35)30$

$A = 35 \times 15$

$\underline{\boldsymbol{A = 525m}}$

Distance B

$x = l \times b$

$x = (20 - 10) \times 30$

$\underline{\boldsymbol{x = 300m}}$

Distance C

$x = \frac{1}{2}bh$

$x = \frac{1}{2}(20 - 25) \times 30$

$\underline{\boldsymbol{x = 75m}}$

$\therefore Total\ distance = A + B + C$

$\underline{\boldsymbol{150 + 300 + 75 = 525m}}$

(f) Time taken = 25s

(g) $Average\ speed = \frac{total\ distance}{total\ time}$

$V_A = \frac{x}{t}$

$V_A = \frac{525}{2s}$

$\boldsymbol{V_A = 21m/s}$

---

23. (a) The object is covering 12m in 1 second.

(b) (i) $a = \frac{v-u}{t}$

$a = \frac{8-0}{4}$

$a = \frac{8}{4}$

$\underline{\boldsymbol{a = 2m/s^2}}$

(ii) $a = \frac{v-u}{t}$

$a = \frac{8-8}{2}$

$a = \frac{0}{2}$

$\underline{\boldsymbol{a = 0m/s^2}}$

When velocity is constant acceleration becomes zero $(\boldsymbol{0m/s^2})$

(iii) $x = \frac{1}{2}bh$

$x = \frac{1}{2} \times 4 \times 30$

$x = \frac{32}{2}$

$\underline{\boldsymbol{x = 16m}}$

---

24. (a) At 2s

(b) $x = \frac{1}{2}bh$

$x = \frac{1}{2} \times 2 \times 8$

$\underline{\boldsymbol{x = 8m}}$

(c) $a = \frac{v-u}{t}$

$a = \frac{0-8}{2}$

$a = \frac{-8}{2}$

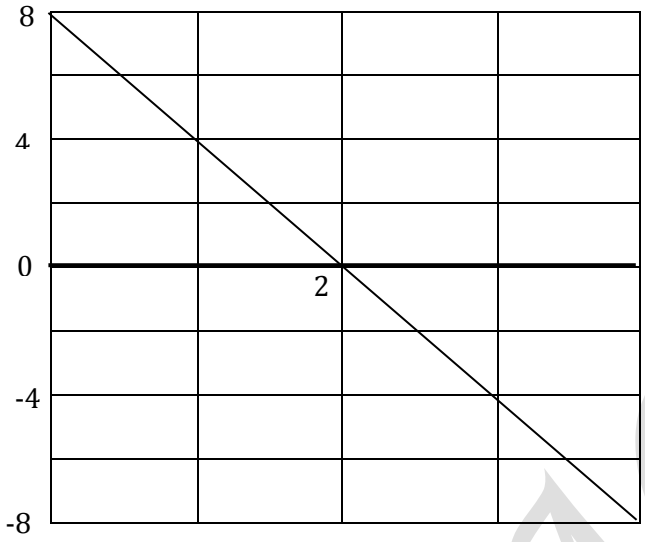
$\underline{\boldsymbol{a = -4m/s^2}}$

(d) Total time

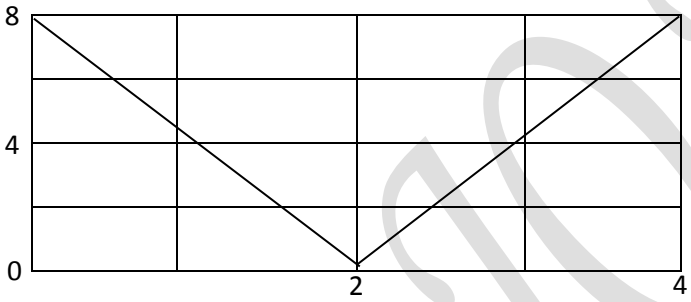
2×2

$\underline{\boldsymbol{4s}}$

(e)(i)



(ii)



---

25. (a) This means that the acceleration of the car is changing by $2m/s^2$ in 1 second.
    (b) Acceleration is the change of velocity per unit time.
    (c) ***Note: just convert $30m/s$ to km/hr and check if the speed of a car exceeds speed limit or not.***

$$\text{Speed} = \frac{30}{1000} \div \frac{1}{3600}$$
$$= \frac{30}{1000} \times \frac{3600}{1}$$
$$= \frac{108000}{1000}$$
$$= \underline{\mathbf{108km/hr}}$$

$$\text{Or} = 30 \times \frac{18}{5}$$
$$= \frac{540}{5}$$
$$= \underline{\mathbf{108km/hr}}$$

∴ The car was over speeding since its speed exceeds the speed limit.

---

26. (a) $t = 3_s + 2_s$
$= \mathbf{5_s}$

(b) $Distance, x = 2.9 - 2.2$
$= \underline{\mathbf{0.7m}}$

(c) $Distance$
$x = 3.9 - 2.9$
$= \underline{\mathbf{1.0m}}$

(d) $Total\ Distance$
$= 3.9 - 2.2$
$= \underline{\mathbf{1.7m}}$
Or
$= 0.7 + 1.0$
$= \underline{\mathbf{1.7m}}$

(e) $Speed$
$V = \frac{x}{t}$
$V = \frac{0.7m}{3_s}$
$= \underline{\mathbf{0.23m/s}}$

(f) $V = \frac{x}{t}$
$V = \frac{1.0m}{2_s}$
$= \underline{\mathbf{0.5m/s}}$

(g) $V_A = \frac{Total\ distance}{Total\ time}$
$V_A = \frac{1.7m}{5_s}$
$= \underline{\mathbf{0.34m/s}}$

27. (a)is the speed in a specified direction.
(b)this is because it has both magnitude and direction.
(c)if an object is moving along a curved or circular path ,the direction of velocity of the object changes. This results in a changing velocity even if speed is constant.

---

28. (a) (i) Is a pull or push exerted on an object.
(ii) Force that opposes motion of a body.
(iii) Tendency of the body to resist change to its present motion.
(b) (i) Newton's (N) (ii) Kilogram (Kg) (iii) Newton's (N) (iv) meters per square second (m/s^2)
(c) F=ma

---

29. (a)

Data
$F = 320N$
$M = 16.8kg$
$a = ?$

$F = ma$
$320 = 16.8 \times a$
$\frac{16.8a}{16.8} = \frac{320}{16.8}$
$\underline{\boldsymbol{a = 19.05m/s^2}}$

(b)

Data
$F = ?$
$M = 3kg$
$a = 2m/s^2$

$F = ma$
$F = 3 \times 2$
$\underline{\boldsymbol{F = 6N}}$

---

30. (i)

Data
$a = ?$
$v = 0m/s$
$u = 30m/s$
$t = 5s$

$a = \frac{v-u}{t}$
$a = \frac{30-0}{5}$
$a = \frac{30}{5}$
$\underline{\boldsymbol{a = 6m/s^2}}$

(ii)

Data
$F = ?$
$M = 400kg$
$a = 6m/s^2$

$F = ma$
$F = 400 \times 6$
$\underline{\boldsymbol{F = 2400N}}$

(iii)

Data
$x = ?$
$v = 0m/s$
$u = 30m/s$
$a = 6m/s^2$

$v^2 = u^2 + 2ax$
$(30)^2 = (0)^2 + 2(6)x$
$900 = 0 + 12x$
$\frac{900}{12} = \frac{12x}{12}$
$\underline{\boldsymbol{x = 75m}}$

31. (i) acceleration = $0m/s^2$; ***Note: when the speed is constant the acceleration is zero*** $\boldsymbol{0m/s^2}$
(ii)
$F = ma$
$F = 15 \times 0$
$\underline{\boldsymbol{F = 0N}}$

Then resultant force = Applied force – friction force
$F_R = F_1 - F_2$
$0 = 75 - F_2$
$F_2 = 75 - 0$
$\boldsymbol{F_2 = 75N}$

Since the crate has constant speed hence the friction force becomes equal to the applied force.
(iii) Heat and sound energy.

---

32. (a) (i) 1. It causes tear(breaking) and wear
2. it opposes motion
3. it causes heating up in machines

4. it produces noise
5.it consumes alot of energy

(ii) 1. It holds objects in position
2. Helps substances to move. (Acids motion)
3. it helps in applying the brakes
4.helps in writing on paper /board with pen/chalk.

(b) 1. Changes shape of an object
2. Changes motion of an object
3. Causes motion
4. Changes the size of an object

---

33. (i) D. Since $R_F = 23N + 25N$

$= \underline{\boldsymbol{48N}}$

(ii) D. Because it has the greatest resultant force

(iii) A to the right
B to the left
C to the right
D to the left

---

34. (a) the extension of the loaded spring is directly proportional to the force applied provided the elastic limit is not exceeded.

(e) $\begin{pmatrix} L_1 = 4N \\ L_2 = ? \\ E_1 = 10mm \\ E_2 = 15mm \end{pmatrix}$

$\frac{E_1}{L_1} = \frac{E_2}{L_2}$

$\frac{10mm}{4N} = \frac{15mm}{L_2}$

$\frac{10mmL_2}{10mm} = \frac{10mm}{10mm}$

$\boldsymbol{L_2 = 6N}$

(c) $\begin{pmatrix} L_1 = 3N \\ L_2 = ? \\ E_1 = 9mm \\ E_2 = 12mm \end{pmatrix}$

$\frac{E_1}{L_1} = \frac{E_2}{L_2}$

$\frac{9mm}{3N} = \frac{12mm}{L_2}$

$\frac{9mmL_2}{9mm} = \frac{36mm}{9mm}$

$\boldsymbol{L_2 = 4N}$

(d) $\begin{pmatrix} L_1 = 5N \\ L_2 = ? \\ E_1 = 13mm \\ E_2 = 16mm \end{pmatrix}$

$\frac{E_1}{L_1} = \frac{E_2}{L_2}$

$\frac{13mm}{5N} = \frac{16mm}{L_2}$

$\frac{13mmL_2}{13mm} = \frac{80mm}{13mm}$

$\boldsymbol{L_2 = 6.2N}$

(e) $\begin{pmatrix} L_1 = 600N \\ L_2 = 800N \\ E_1 = 10cm \\ E_2 = ? \end{pmatrix}$

$\frac{E_1}{L_1} = \frac{E_2}{L_2}$

$\frac{10cm}{600N} = \frac{E_2}{800N}$

$\frac{600NE_2}{600N} = \frac{8000N}{600N}$

$\boldsymbol{E_2 = 13.3cm}$

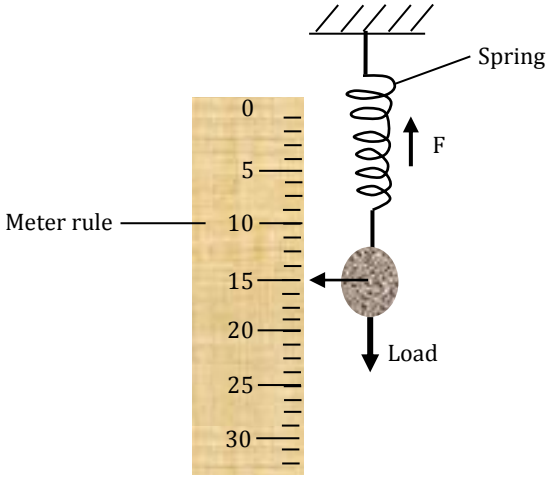
$E_2 = \frac{13.3cm}{100cm.m}$

$\boldsymbol{E_2 = 0.13m}$

(f)(i) The ability of a material to return to its original shape after a deforming force is removed.
(ii) Is the increase in length of the spring when it is loaded.

(iii) It is the maximum force that can be applied to a spring without stretching permanently

(g) The apparatus are set as shown below



With no load attached to the spring ,record the reading of the pointer on the metre rule as l_0 .attach a 100g mass to the spring and record the new pointer reading as l repeat the procedure with five more 100g masses attached in succession and record l for each additional mass in the table below.

Total mass, m(g)	**Load (N)**	**L (mm)**	**Extension =(l-lo)mm**
100	1		
200	2		
300	3		
400	4		
500	5		
600	6		

Then using the results plot a graph of extension (mm) against load (N) and draw a line of best fit .if the line is a straight line passing through the origin ,then the limit of proportionality has not been exceeded.

35.....part ONE

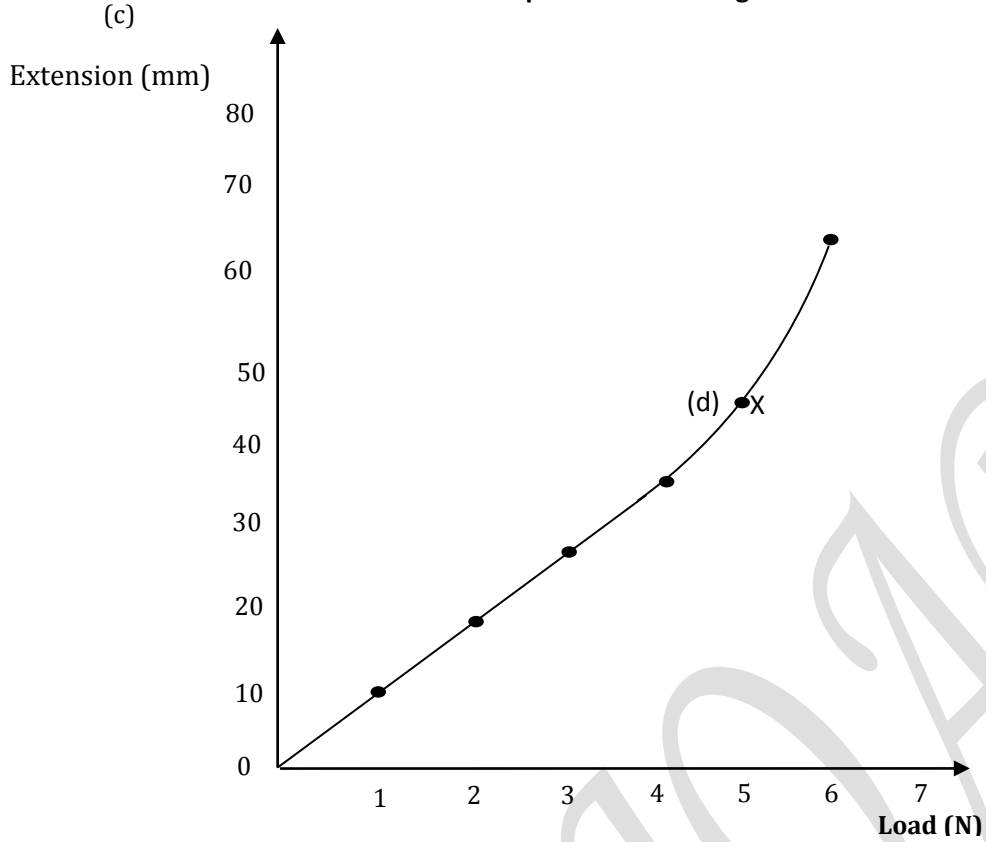
(a) The unstretched length is 40mm

(b)

Load /N	0	1	2	3	4	5	6
Length /mm	40	49	58	67	76	88	100
Extension /mm	**0**	**9**	**18**	**27**	**36**	**48**	**70**

Graph of extension against load

(c)



(e) 0 N – 4N

(f) 2.8N

35. **Part two** (a) Energy =$E_p = 50J$. since work = Energy

(b) Energy = E_k =50J. E_P=E_k (conservation of energy)

(c) The potential energy is converted to kinetic energy.

(d) Energy cannot be created nor destroyed but it can only be transformed from one form to another.

---

36. (a) Using the conservation of energy we say:

$E_k = E_p$.

E_p =mgh

$E_p = 4\cancel{kg} \times 10N/\cancel{kg} \times 2m$

E_p =<u>80J</u>

(b) Conservation of energy

E_p = mgh

$E_p = 4\cancel{kg} \times 10N/\cancel{kg} \times 5m$

E_p = <u>200J</u>

∴ Since energy $E_k = E_p$ = 200J

$E_k = {}^1/_2\, mv^2$

$200 = {}^1/_2\, 4 \times v^2$

$\frac{200}{1} = \frac{4v^2}{2}$

$\frac{4v^2}{4} = \frac{400}{4}$

$\sqrt{v^2} = \sqrt{100}$

$\boldsymbol{v = 10m/s}$

---

37. (a) $E_k = {}^1/_2\, mv^2$

$E_k = {}^1/_2 \times 0.5 \times (10)^2$

$E_k = {}^1/_2 \times 0.5 \times 100$

$E_k = \frac{50}{2}$

$\boldsymbol{E_k = 25J}$

(b) Conservation of energy.

$E_{Gp} = {}^1/_2\, mv^2$

$E_{Gp} = {}^1/_2 \times 0.5 \times (10)^2$

$E_{Gp} = {}^1/_2 \times 0.5 \times 100$

$E_{Gp} = \frac{0.5\times100}{2}$

$\boldsymbol{E_{Gp} = 25J}$

(c) E_p = mgh

$25J = 0.5 \times 10 \times h$

$\frac{25J}{5} = \frac{\cancel{5}h}{\cancel{5}}$

<u>h = 5m</u>

OR

$v^2 = u^2 + 2ax$

$(10)^2 = 0^2 + 2(10)x$

$100 = 0 + 20x$

$\frac{100}{20} = \frac{\cancel{20}x}{\cancel{20}}$

$x = 5m$

<u>Height = 5m</u>

---

38. (a) P output = 1000w – 1kw

X – 3kw

$= \frac{x\cancel{kw}}{\cancel{kw}} = \frac{3000\cancel{kw}.w}{\cancel{kw}}$

$\boldsymbol{\underline{x = 3000w}}$

(b) $\frac{P}{1} = \frac{w}{t}$

$w = pt$

$w = 3000w \times 1s$

$w = 3000w.s$

$\boldsymbol{w = 3000J}$

(c) $w = pt$

$w = 3000w \times 20s$

$w = 60{,}000w.s$

$\boldsymbol{w = 60{,}000J}$

(d) $Eff = \frac{power\ output}{power\ input} \times 100\%$

$= \frac{3000w}{4000w} \times 100\%$

$\underline{= \mathbf{75\%}}$

39. (a) These are energy resources which can be exhausted and cannot be replaced.
(b) To produce energy for industry and domestic consumption e.g. energy for transportation, generation of electricity.
(c) Uranium
(d) 1. They do not run out while non renewable resources run out.
2. They have low carbon and greenhouse emissions compared to non renewable resources Of energy.
3. They are reliable sources of energy as opposed to non renewable resources of energy.
4. They are cheaper than non renewable sources of energy.

40. (a) (i) Elastic potential energy
(ii) it is converted to kinetic energy.
(b) $E_p = mgh$
$E_p = 0.1 \times 10 \times 0.75$
$E_p = \underline{0.75J}$

Convert 75cm to m
$\frac{75}{100} = 0.75m$

(d) Because some of the energy was lost to overcome friction

41. (a) (i) Work is the product of a force and the perpendicular distance in the direction of a force.
(ii) Energy is the ability to do work.
(iii) Power is the rate at which work is done. / The rate at which energy is consumed.
(iv) Efficiency is the ratio of useful work done (output) to the work done (input) expressed as a percentage.
(b) Power output.
$P = \frac{w}{t}$ ***Since w= mgh***
$\therefore P = \frac{mgh}{t}$
$P = \frac{100 \times 10 \times 19}{20}$
$P = \frac{19000}{20}$
$\underline{\boldsymbol{P = 950w}}$

Efficiency
$E = \frac{work\ output}{work\ input} \times 100\%$
$E = \frac{950}{1000} \times 100\%$
$E = \frac{95000\%}{1000}$
$\underline{\boldsymbol{E = 95\%}}$

42. Since the pendulum shows the transformation of energy between E_p and E_k therefore the transformation of energy will be considered.
(i) E_p (gain) = E_k (loss)
$E_p = E_k$
$mgh = {}^1/_2 mv^2$
$gh = {}^1/_2 v^2$
$gh = \frac{v^2}{2}$
$\sqrt{v^2} = \sqrt{2gh}$
$\underline{\boldsymbol{v = \sqrt{2gh}\ hence\ shown.}}$

(ii) $v = \sqrt{2gh}$

$v = \sqrt{2 \times 10 \times 0.5}$

$v = \sqrt{10}$

$\underline{\therefore \boldsymbol{v = 3.16m/s}}$

---

43. (a) Potential energy is the energy possessed by bodies at rest.

(a) $E_{G.p} = mgh$

$= 50 \times 10 \times (0.15 \times 5)$

$= 50 \times 10 \times 0.75$

$\underline{= \mathbf{375J}}$

(b) $P = \frac{w}{t}$

$since\ w = E_p$

$\therefore P = \frac{E_p}{t}$

$P = \frac{375}{5}$

$\underline{\boldsymbol{P = 75w}}$

---

44. (a) $E_p = mgh$

$= 2 \times 10 \times 20$

$\underline{= \mathbf{400J}}$

(b) $\boldsymbol{E_k = 0J}$ **:** this is because there is no motion and V is zero.

(c) $E_k = E_p$

$\boldsymbol{E_k = 400J}$

Using the conservation of energy concept the solution will be as follows.

All the E_p has been converted to E_k.

(d) $E_k = {}^{1}/_{2}\, mv^2$

$400 = {}^{1}/_{2} \times 2 \times v^2$

$\frac{2v^2}{2} = \frac{800}{2}$

$\sqrt{v^2} = \sqrt{400}$

$\underline{\boldsymbol{v = 20m/s}}$

---

45. (a) power is the rate at which energy is consumed

(b) $P = \frac{w}{t}$

Data

P=?

F=10N

m=10kg

V=2m/s

$P = \frac{w}{t}$ $\quad$ $\boldsymbol{since\ w = f.x}$

$\therefore P = \frac{f.x}{t}$

$from\ v = \frac{x}{t}$ $\quad$ $\boldsymbol{we\ get}$

$x = vt, and\ replace\ it\ in\ P = \frac{f.x}{t}$

$\therefore P = \frac{fv\cancel{t}}{\cancel{t}}$ $\quad$ $\boldsymbol{cancel\ out\ t}$

$P = fv$

$P = 10N \times 2m/s$

$P = 20N.m/s$

$\underline{\therefore \boldsymbol{P = 20w}}$

(c) $P = \frac{w}{t}$ $\quad$ $\boldsymbol{since\ w = E_p}$

$\therefore P = \frac{E_p}{t}$

$P = \frac{mgh}{t}$

$P = \frac{200\times10\times100}{20}$

$\underline{\underline{\boldsymbol{P = 10000w}}}$

(d) $E_{G.p}$ Is the energy possessed by bodies which are raised whereas $E_{e.p}$ is the energy possessed by compressed or stretched objects.

---

46. (a) Is the ratio of useful work done (output) by a machine to the work done (input) expressed as a percentage.

Energy output = $E_p = mgh$

$= 80 \times 10 \times 20$

$\underline{\underline{= \mathbf{16000J}}}$

Energy input = $E_p = 40 \times 1000$

$\underline{\underline{= \mathbf{40,000J}}}$

(b) $E = \frac{energy\ output}{energy\ input} \times 100\%$

$= \frac{16000}{40{,}000} \times 100\%$

$= \frac{1600{,}000\%}{40{,}000}$

$\underline{\underline{= \mathbf{40}\%}}$

(c) Data

Energy output = mgh

$= 50 \times 10 \times 15$

$\underline{\underline{= \mathbf{7500J}}}$

$energy\ input = 50 \times 100$

$\underline{\underline{= \mathbf{50,000J}}}$

$eff = \frac{energy\ output}{energy\ input} \times 100\%$

$= \frac{7500}{50{,}000J} \times 100\%$

$\underline{\underline{= \mathbf{15}\%}}$

(d) Efficiency $= \frac{work\ output}{work\ input} \times 100\%$

$= \frac{f.x}{f.x} \times 100\%$

$= \frac{80\times0.8}{35\times2} \times 100\%$

$\underline{\underline{= \mathbf{91 \cdot 43}\%}}$

---

47. (a) Energy is neither created nor destroyed but can only be transformed from one form to another.

(b) $E_k = {}^1/_2\, mv^2$

$E_k = {}^1/_2 \times 0.5 \times (10)^2$

$E_k = {}^1/_2 \times 0.5 \times 100$

$\boldsymbol{E_k = 25J}$

(c) $\boldsymbol{E_{G.p} = 25J}$

(d) $E_p = E_k$

$\cancel{m}gh = {}^1/_2\, \cancel{m}v^2$

$\frac{\cancel{g}h}{\cancel{g}} = \frac{{}^1/_2 v^2}{g}$

$h = {}^1/_2\, v^2/g$

$h = {}^{1}/_{2} \times {}^{(10)^2}/_{10}$

$\underline{\boldsymbol{h = 5m}}$

48. $E_p = mgh$

$E_p = 4 \times 10 \times 2$

$\boldsymbol{E_p = 80J}$

$\therefore$ *since* $E_p(loss) = E_k(gain)$. Potential energy is transformed to kinetic energy.

$\boldsymbol{E_k = 80J}$

---

49. (a) Potential energy

$E_k = mgh$

$= 4 \times 10 \times 5$

$\underline{= \mathbf{200J}}$

(b) From the potential energy of the stone at rest to kinetic energy of the stone in motion.

(c) $E_p = E_k$

$E_p = {}^{1}/_{2}\, mv^2$

$200 = {}^{1}/_{2}\, mv^2$

$200 = {}^{1}/_{2} \times 4 \times v^2$

$\frac{200}{1} = \frac{4v^2}{2}$

$\frac{4v^2}{4}\frac{400}{4}$

$\sqrt{v^2} = \sqrt{100}$

$\underline{\boldsymbol{v = 10m/s}}$

(d) Speed (v) = 10m/s.

Note: *if the stone fell vertically, it would start with the same gravitation P.E and end up with the K.E, so its final speed would be 10m/s.*

---

50. (a) A: gravitational potential energy

B: kinetic energy and potential energy

C: kinetic energy

(b) The initial has been converted to internal energy due to air resistance.

---

51. (a) $E_p = mgh$

$= 2 \times 10 \times 1$

$\underline{= \mathbf{20J}}$

(b) $\boldsymbol{E_p = 20J}$

(c) $E_p = E_k$

$20 = {}^{1}/_{2}\, mv^2$

$20 = {}^{1}/_{2} \times 2 \times v^2$

$\frac{20}{1} = \frac{2v^2}{2}$

$\sqrt{v^2} = \sqrt{20}$

$\underline{\boldsymbol{v = 4.47m/s}}$

---

52. Power for lifting

P $= \frac{w}{t}$

P $= \frac{mgh}{t}$

P $= \frac{100 \times 10 \times 8}{4}$

$\underline{\mathbf{P = 2000w}}$

Total power $= 2000 + 0w$

Power for holding the crate

P $= \frac{w}{t}$

P $= \frac{0}{20}$

$\boldsymbol{P = 0w}$

Since the crate was stationed, the work done therefore was 0w

$\underline{\boldsymbol{P = 2000w}}$

53. (a) (i) $E_p = mgh$
$= 200 \times 10 \times 200$
$\underline{= \mathbf{400,000J}}$

54. 1.electrical energy
2.chemical energy
3.mechanical energy
4.heat and light energy
5.sound energy
6.heat and light energy

55. (a)when the pendulum is released its gravitational potential energy is converted to kinetic energy. At half its journey the potential energy becomes equal to kinetic energy. As it continues its kinetic energy is converted to gravitational potential energy and back.
(b) The gravitational potential energy is converted to kinetic energy and finally the initial energy is converted to internal energy.
(c) (I) Renewable source of energy has low carbon emission hence environment friendly while non renewable source of energy has high carbon emission hence not environment friendly.
(ii) Renewable source
-solar energy
-wind energy
-hydropower
Non renewable source
-fossil fuel
-natural gas
-nuclear power
(iii)1. Potential energy
2. Kinetic energy
3.chemical energy

MOMENTS AND STABILITY

56. (a) 1. The sum of the clockwise moment about any point must be equal to the anticlockwise moments about the same point.
2. the forces in the x-axis and the y-axis must be equal to zero.

(b) The sum total of the clockwise moments about a point must be equal to the sum total of the anticlockwise moment about the same point.

(c) (i) $M = Fd$
$M = 4N \times 4m$
$\boldsymbol{M = 16N}$

(ii) $M = Fd$
$M = 6N \times 2m$
$\boldsymbol{M = 12N}$

(d) *Note: Check using the principle of moments.*
$F_1 d_1 = F_2 d_2$
$6N \times 2m = 4N \times 4m$
$\boldsymbol{12Nm = 16Nm}$
It will not balance, the 6N weight will move upwards.

Note: This happens because the moments about 0 are not balanced.

(e) $F_1 d_1 + F_2 d_2 = F_3 d_3$
$(P \times 4) + (6 \times 2) = 4 \times 4$
$4P + 12 = 16$
$4P = 16 - 12$
$\frac{4P}{4} = \frac{4}{4}$
$\boldsymbol{P = 1N}$

(f) Downwards

---

57. (a)(i) Moment of a force is the product of force and perpendicular direction from one point of application.

Note: ***You can also say moment of force is the turning effect of a force about a point***

(ii) Total clockwise moments are equal to total anticlockwise moments.

---

58. (a)(i) Force B, since the perpendicular distance from the centre of the nut and the point of application is bigger than that of A hence it will produce a larger turning effect.

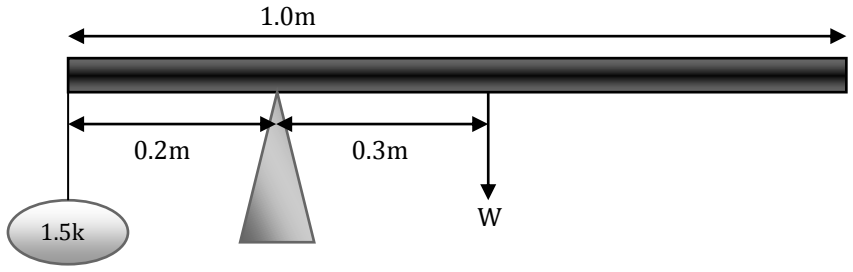
(ii) Turning effect is the moment
$\therefore M = Fd$
$M = 2N \times 0.3m$
$\boldsymbol{M = 0.6Nm}$

Note: convert 30cm to meters as a standard unit for distance

(iii) This is because it makes work to be done easily.

(b) Opening and closing a window
Opening and closing a tap.
See-saw

59.



$F_1 d_1 = F_2 d_2$

$(1.5 \times 10) \times 0.2 = w \times 0.3$

$15 \times 0.2 = w \times 0.3$

$\frac{3}{0.3} = \frac{0.3w}{0.3}$

$\underline{\boldsymbol{w = 10N}}$

---

60. (a) $M = Fd$

$M = 20N \times 0.2m$ [***Convert 20cm to meters (0.2m)***]

$\underline{\boldsymbol{M = 0.4Nm}}$

(b) $F_1 d_1 = F_2 d_2$

$w \times 0.25m = 2N \times 0.2m$

$\frac{0.25mW}{0.25m} = \frac{0.4Nm}{0.25m}$

$\underline{\boldsymbol{W = 16N}}$

---

61. (a) Convert 200g to weight and 16cm to meters.

Data

$16cm - x$

$100cm - 1m$

$\frac{\cancel{100cm}.x}{\cancel{100cm}} = \frac{16cm.m}{100cm}$

$\underline{\boldsymbol{x = 0.16m}}$

$\therefore F_1 d_1 = F_2 d_2$

$2N \times 0.16m = B \times 0.16m$

$\frac{0.32Nm}{0.16m} = \frac{\cancel{0.16m}.B}{\cancel{0.16m}}$

$B = 2N$

$\underline{\boldsymbol{weight\ of\ B\ is\ 2N}}$

Data

$16cm - x$

$100cm - 1m$

$\frac{\cancel{100cm}.x}{\cancel{100cm}} = \frac{16cm.m}{100cm}$

$\underline{\boldsymbol{x = 0.16m}}$

Then: $W = mg$

$W = 0.2 \times 10$

$\underline{\boldsymbol{W = 2N}}$

(b) $M = Fd$

$M = 2N \times 0.16m$

$\underline{\boldsymbol{M = 0.32Nm}}$

(c)(i) $w = mg$

$w = 0.2\cancel{kg} \times 1.7N/\cancel{kg}$

$\underline{\boldsymbol{w = 0.34}}$

Note: Use the mass of B in kg to find the weight of B on the moon.

(ii) Because mass does not change hence it will balance even on the moon.

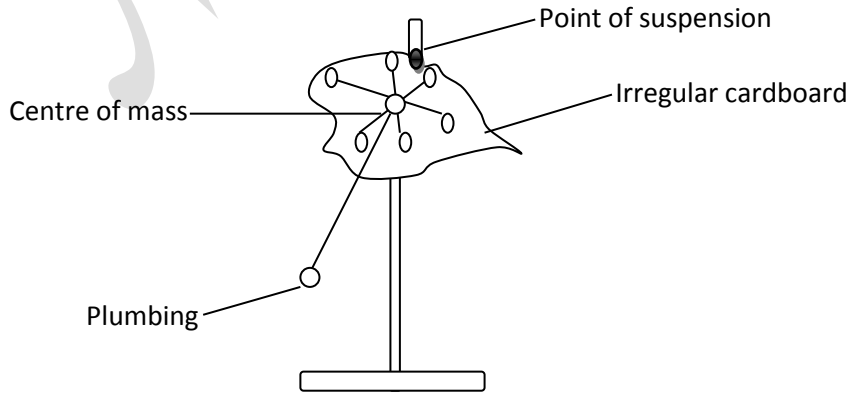
---

62. (a) This is a point on an object where its entire weight seems to concentrate.

(c) Take a piece of card board such as a lamina and cut it out into an irregularly shaped object using a pair of scissors.

Make several holes mere spaced around the cardboard vertically from the pin clamp stand. Check that the card is free to swing by pulling it on side and then releasing it. Suspend the plumbing from each hole making sure where the lines are drawn.

The point where the lines criss- cross is the centre of mass as indicated in the diagram below.



(c) When the roof rack is heavily loaded the centre of mass of a minibus is raised making it less stable hence can

easily topple over than when it is empty.

(d)(i) $M = Fd$

$M = 0.45N \times 0.2m$

$\underline{\boldsymbol{M = 0.1125Nm}}$

$25 - x$

$100cm - 1m$

$\frac{\cancel{100cm}.x}{\cancel{100cm}} = \frac{25\cancel{cm}.m}{100\cancel{cm}}$

$\underline{\boldsymbol{x = 0.25m}}$

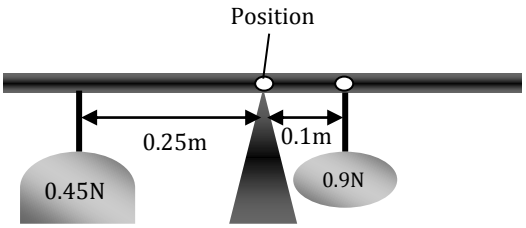
$25cm - x$

$100cm - 1m$

$\frac{(100cm.x)}{100cm} = \frac{25cm.x}{100cm}$

$\underline{\boldsymbol{x = 0.25m}}$

(ii)



$F_1 d_1 = F_2 d_2$

$0.45N \times 0.25m = 0.90N \times d_2$

$\frac{0.1125Nm}{0.90N} = \frac{0.90Nd_2}{0.90N}$

$\therefore \boldsymbol{d_2 = 0.125m}$

$d_2 = 0.125m$

$40cm + 12.5cm$

$\underline{\boldsymbol{= 52.5cm}}$

---

63. (a) For the an object that is in equilibrium the sum total of the clockwise moments at a point is equal to the sum total

of the anticlockwise moments at the same point.

(b) $F_1 d_1 = F_2 d_2$ ***Convert cm to m***

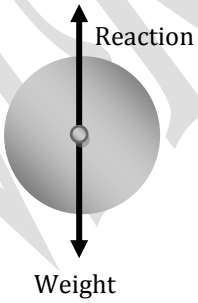
$500N \times 0.02 = F_2 \times 0.12$

$\frac{10Nm}{0.12m} = \frac{0.12Nf_2}{0.12m}$

$\boldsymbol{F_2 = 83.3N}$

---

64. (a)



(b)(i) $M = fd$

$M = 20N \times 1.5m$

$\underline{\boldsymbol{M = 30Nm}}$

(ii) $f_1 d_1 = f_2 d_2$

$80N \times 1.5m = 80N \times Am$

$\frac{80N.Am}{80N} = \frac{80Nm}{80N}$

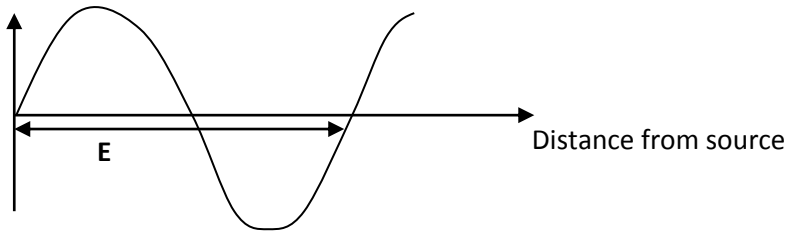
$\underline{\boldsymbol{Am = 0.375m}}$

---

65. (i) A.

(ii) C.

(iii)



(iv) $V = f\lambda$

$f = \frac{V}{\lambda}$

$f = \frac{\frac{34m}{s}}{0.5m}$

$\underline{\boldsymbol{f = 68Hz}}$

---

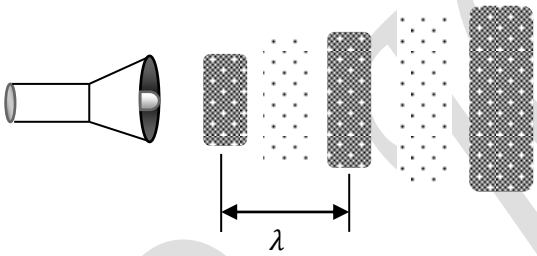
66. (a) P is compression

Q is rarefaction

(b) Pressure decreases as a wave moves from P to Q causing compression and rarefactions.

(c) They are vibrating parallel to the direction of wave motion

(d)



(e) $V = \frac{x}{t}$

$\frac{340m/s}{1} = \frac{17oom}{t}$

$\frac{\cancel{340m/s}.t}{\cancel{340m/s}} = \frac{1700m}{340\cancel{m}/s}$

$\underline{\boldsymbol{t = 5s}}$

---

67. (a) (i) In longitudinal waves individual particles vibrate parallel to the direction of wave motion whereas in a transverse wave they vibrate perpendicular to the direction of wave motion.

(ii)

Longitudinal waves	Transverse waves
- Sound wave - Waves in a spiral spring - Primary seismic waves	- Water wave - Waves in generated rope - Secondary seismic waves

(b) When a particle of a medium vibrates it causes the neighbouring particles to vibrate, as the process continues the energy is transferred from one point to another.

(c) (i)

---

68. (a) Amplitude = *5m*

(b) Period = *20m*

(c) $f = \frac{1}{T}$

$f = \frac{1}{20}$

$\underline{\boldsymbol{f = 0.05Hz}}$

(d) $V = f\lambda$

$\frac{1.02}{0.05} = \frac{0.05\lambda}{0.05}$

$\underline{\boldsymbol{\lambda = 20.4m}}$

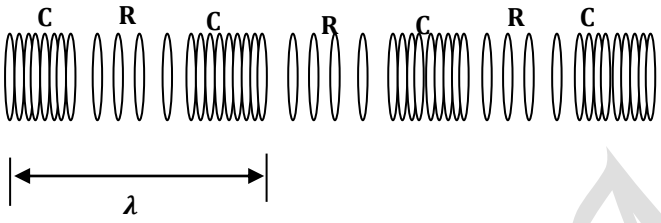
---

69. (a) (i) Frequency is the number of complete waves generated by the source in one second.

(ii) Wavelength is the distance between two successive crests and toughs.

(iii) Amplitude is the maximum displacement of a particle in a vibrating from its resting position.

(b)



(c) Longitudinal wave

(d) In a sound wave vibration are parallel to the direction of motion while those in a transverse wave are perpendicular to the direction of wave motion.

(e) $V = f\lambda$

$V = 20 \times 0.02$

$\underline{\boldsymbol{V = 0.4m/s}}$

---

70. (i) Amplitude $= \frac{0.3m}{2}$

$\underline{\boldsymbol{= 0.15m}}$

(ii) $f = \frac{1}{T}$

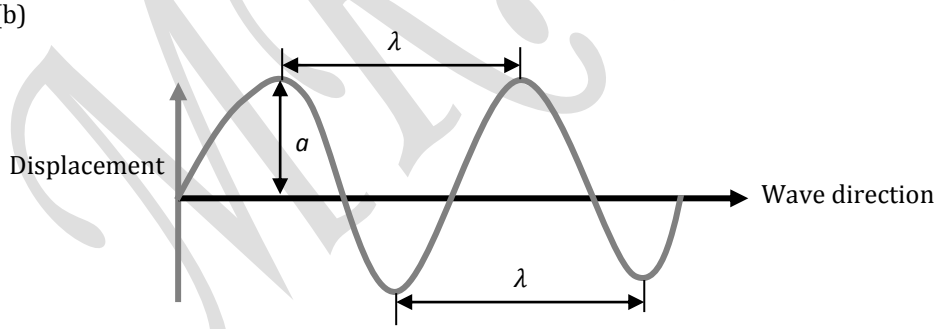
$f = \frac{1}{0.4}$

$\underline{\boldsymbol{f = 2.5Hz}}$

---

71. (a) Wave speed is the distance covered by a wave per unit time.

(b)



Key: λ is the wavelength

: a is the amplitude

Amplitude is the maximum displacement of a particle in a vibration from its resting position.

Wavelength is the distance between two successive crest or troughs.

(c) $V = f\lambda$

(d) (i) $V = \frac{x}{t}$

$\frac{330}{1} = \frac{x}{6}$

$\underline{\boldsymbol{x = 1980m.}}$

(ii) $V = \frac{2x}{t}$

$\frac{330}{1} = \frac{2x}{6}$

$\frac{\cancel{2}x}{\cancel{2}} = \frac{1980}{2}$

$\underline{\boldsymbol{x = 990m}}$

NOTE: consider echo in (ii) which travels 2 distances to and fro.

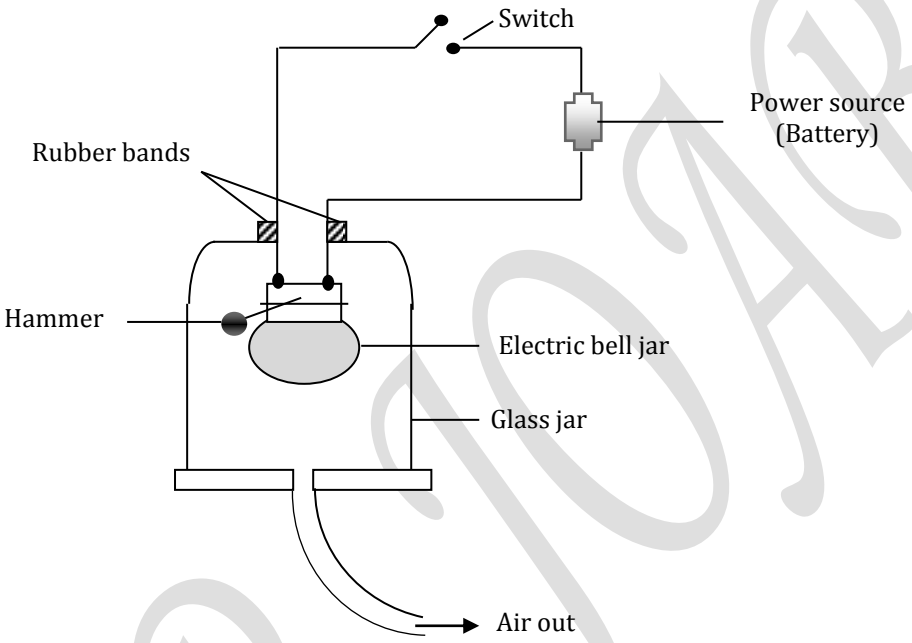
72. (a) Graph A.

(b) 1. Pitch, the higher the frequency the higher the pitch and vice versa.

2. Loudness, the larger the amplitude the louder the sound and vice versa.

3. Quality.

(c) Hang an electric bell under a bell jar and connect to a battery so that it rings as shown below.



When the switch is closed, the hammer strikes the bell and the sound is heard louder. Slowly remove the air from the bell jar by means of a suction pump (vaccum pump), as the density of air decreases, the sound also becomes faint until no more sound can be heard through the hammer continues to strike the bell. Slowly readmit the air into a bell jar by using the same vaccum pump. As air density of air increases, the sound also becomes loud and louder again. This shows that sound requires a material (tangible) medium for its transmission.

73. (a) (i) Infra-red is transverse

(ii) Sound is longitudinal

(iii) Radio is transverse

(iv) Light is transverse

(v) Waves in a spiral spring is longitudinal

(vi) Ripples on water is transverse.

(b) Frequency (f) = 279Hz. ***(use the definition for frequency)***

(c) During lightening light is seen first then sound of thunder is heard though they are produced at the same time, this shows that light travels faster than sound.

(d) Two experiments, one with a stop watch and the other one with a pistol containing blank bullets, and stand at a measured distance from one another such 1km apart.

The friend with a pistol signals to the friend that he is about to fire and he fires. The friend with a clock starts the clock as soon as he hears the sound of a pistol. He takes note of the of time taken for the sound to reach him. Then the experiment is repeated several times and the average time is recorded. To minimize the effects of wind two experimenters exchange their position and repeat the experiment.

- Speed is calculated by using the formula

$$\boldsymbol{speed = \frac{distance}{time}}$$

(e) $V = \frac{2x}{t}$

$\frac{\cancel{2}x}{\cancel{2}} = \frac{Vt}{2}$

$x = \frac{Vt}{2}$

$x = \frac{1410 \times 3}{2}$

$\underline{\boldsymbol{x = 2115m}}$

---

74. (a) (i) Amplitude (a)=0.6m

(ii) $\lambda = 20m$

(b) $\frac{V}{1} = \frac{2x}{t}$

$\frac{2x}{2} = \frac{Vt}{2}$

$x = \frac{330 \times 3}{2}$

$x = \frac{990}{2}$

$\underline{\boldsymbol{x = 495m}}$

$V = \frac{x}{t}$

$\frac{330}{1} = \frac{x}{3}$

$\underline{\boldsymbol{x = 990m}}$

---

75. (a) (i) Note: time for one cycle = 0.02_s.

$\therefore f = \frac{1}{T}$

$f = \frac{1}{0.02}$

$\underline{\boldsymbol{f = 50Hz}}$

$V = f\lambda$

$2cm/s = 50c/s \times \lambda$

$\frac{50\lambda}{50} = \frac{2cm/s}{50}$

$\underline{\boldsymbol{\lambda = 0.04cm}}$

OR

$V = \frac{\lambda}{T}$

$\frac{2}{1} = \frac{\lambda}{0.02}$

$\underline{\boldsymbol{\lambda = 0.04cm}}$

(ii) Amplitude = 0.06cm

(b) $V = \frac{2x}{t}$

$\frac{1450}{1} = \frac{2x}{1}$

$\frac{2x}{2} = \frac{1450}{2}$

$x = 725m$

$\underline{\boldsymbol{\therefore Depth = 725m}}$

---

76. (a)(i) Period = 5 – 1

$\underline{\boldsymbol{= 4s}}$

T is the distance between points which are in phase.

(ii) $f = \frac{1}{T}$

$f = \frac{1}{4}$

$\underline{\boldsymbol{f = 0.25Hz}}$

(iii) $V = \frac{\lambda}{T}$

$\frac{3cm/s}{0.25s} = \frac{025s.\lambda}{0.25s}$

$\lambda = 12cm$

$\underline{\boldsymbol{\lambda = 0.12m}}$

(b) (i) $V = \frac{\lambda}{T}$ ***(convert 10cm to m)***

$V = \frac{0.1}{6}$

$\underline{\boldsymbol{V = 0.017m/s}}$

(ii) $F = \frac{1}{T}$

$\frac{20}{1} = \frac{2\times60}{T}$

$\frac{20T}{20} = \frac{120}{20}$

$\underline{\boldsymbol{T = 6s}}$

Note: $1 = time\ for\ a\ given\ No. = 0f\ waves, in\ the\ case\ converting$ *2minutes to seconds it will be* $2 \times 60 = 120s$ *and* $f = 20Hz$

PRESSURE, GAS LAWS & KINETIC THEORY OF MATTER

77. (a)(i) Solid/liquid
    (ii) Liquid
    (iii) Gas
    (b) 17℃
    (c) 115℃
    (d) H remains constant
    (e) Because it is boiling at 115℃ and water boils at 100℃, hence it is not water.

78. (a)They are in acontinous random motin (zig-zag) motion.
    (b) $V_1P_1 = V_2P_2$

Data

$V_1 = 12m^3$
$P_1 = 1atm$
$P_2 = 4atm$
$V_2 = ?$

$72m^3 \times 100{,}000Pa = 30cm^3 \times P_2$

$\frac{30cm^3P_2}{30cm^3} = \frac{720{,}000m^3.Pa}{30cm^3}$

$\boldsymbol{P_2 = 240.000Pa}$

    (c) For a fixed mass of a gas ,the pressure is inversely proportional to the volume provided the temperature remain constant.

79. (a)Smoke particles
    (b) Because of the collisions with the air molecules.
    (c)Rate of motion would increase hence increasing the number of collision.

80. (a)when the molecules of a gas are constantly striking and bouncing off walls of the container ,the force of these impacts exerts a pressure on the walls of a container.
    (b)when the temperature is increased the gas particles gains more kinetic energy and their speed increase and begin to collide frequently with each other hence increasing the pressure.
    (c)when a balloon is squashed the air inside it warms up slightly making the gas particles increase their speed due to the gain of kinetic energy and starts striking and bouncing off the walls of a balloon hence increasing the pressure.

81. (a)volume decrease {Boyle's law}
    (b)volume increase {Charles's law}
    (c)Pressure decrease {Pressure law}

82. (a)Pressure increase. This is due to frequent collisions between the particles and the walls of the container.{Boyle's law}
    (b)Volume increase .Gas particles hit the walls harder pushing it outwards more until pressure is equalised.

{Charle's law}.

(c)Temperature decrease. This is so because gas particles starts to move slower so they hit the walls less harder.{Pressure law}.

(d)volume increase .particles are moving with the same speed but don't hit the walls as often when the volume increases .{Bayle's law}.

(e)Pressure increases. This is because they hit each other and the walls of the container harder.{pressure law}.

(f)Pressure increases. Since they are larger ,they hit each other and the walls of the container with more force than the lighter particles when hitting at the same speed.

NOTE: Their Kinetic energy is related to their mass and speed ,with the same speed ,a larger mass means more Kinetic to give .

---

83. (a)because the temperature of the gas was increased which caused frequent collisions between the gas particles and the walls of the cylinder.

(b)The constant striking and bouncing off the gas particles and the walls of the cylinder.

(c)

$V_1P_1 = V_2P_2$

Data

$V_1 = 12m^3$
$P_1 = 1atm$
$P_2 = 4atm$
$V_2 = ?$

$12m^3 \times 1atm = V_2 \times 4atm$

$\frac{4atm.V_2}{4atm} = \frac{12atm.m^3}{4atm}$

$\boldsymbol{V_2 = 3m^3}$

Note: *if the units are uniform there is no need of converting them, say* ***atm*** *to* ***Pa***

∴ Try to convert and calculate the V_2:

1atm is called standard atmospheric pressure and its equal to 100, 000Pa.

1atm = 100, 000Pa

---

84. (a)pressure is a force acting normally per unit area

(b)-Decrease

-Decrease

(c)

$P = \frac{F}{A}$

$\frac{100Pa}{1} = \frac{F}{6m^2}$

$F = 600Pam^2$

$\boldsymbol{F = 600N}$

Note: $1Pa/m^2 = 1N$

Hence: $600Pa.m^2 = 600N$

(d)(i) $P = \frac{F}{A}$

$P = \frac{200N}{4m^2}$

$P = 50N/m^2$

$\boldsymbol{P = 50Pa}$

(ii) $P = \frac{F}{A}$

$P = \frac{200N}{2m^2}$

$P = 100N/m^2$

$\boldsymbol{P = 100Pa}$

(e)(I) $P = \frac{F}{A}$

$\frac{1000Pa}{1} = \frac{F}{0.2m^2}$

$\boldsymbol{F = 200N}$

(ii) $P = \frac{F}{A}$

$\frac{210Pa}{1} = \frac{F}{0.2m^2}$

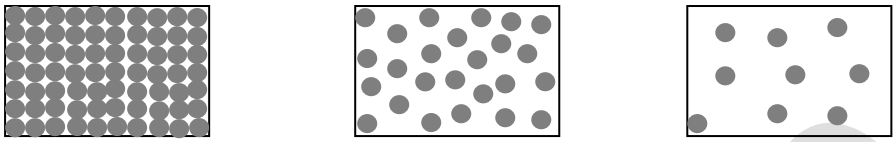
$\boldsymbol{F = 42N}$

THERMAL PROPERTIES AND HEAT TRANSFER

85. (a) Gas (b) Solid (c) Solid (d) Liquid
(e) Gas (f) Liquid (g) Gas

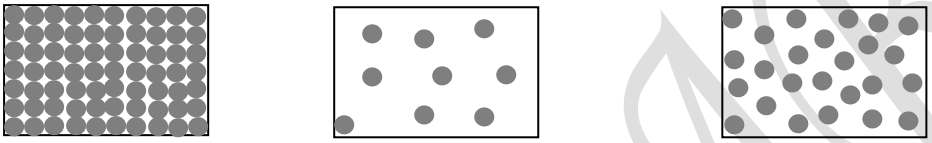
---

86. (a)



Solid Liquid Gas

(b) $-20℃$ $112℃$ $22℃$



(c) (i) 1. Have definite shape
2. They have fixed volume
(ii) 1. Have no definite shape
2. Have a fixed volume
(iii) 1. Have no definite shape
2. Have no fixed shape

---

87. (a)is a measure of the kinetic energy in particles (molecules/atoms)of a substance.

(b) (i) $K = ℃ + 273$
$K = -273 + 273$
$\underline{\boldsymbol{K = 0k}}$

(ii) $K = ℃ + 273$
$K = 0 + 273$
$\underline{\boldsymbol{K = 273k}}$

(iii) $K = ℃ + 273$
$K = 110 + 273$
$\underline{\boldsymbol{K = 383k}}$

(iv) $K = ℃ + 273$
$K = -28 + 273$
$\underline{\boldsymbol{K = 245k}}$

(c)(i) $K = ℃ + 273$
$27 = ℃ + 273$
$27 - 273 = ℃$
$\underline{℃ = \mathbf{246}℃}$

(ii) $K = ℃ + 273$
$℃ = 111 - 273$
$\underline{℃ = \mathbf{162}℃}$

(iii) $℃ = K - 273$
$℃ = 100 - 273$
$\underline{℃ = \mathbf{173}℃}$

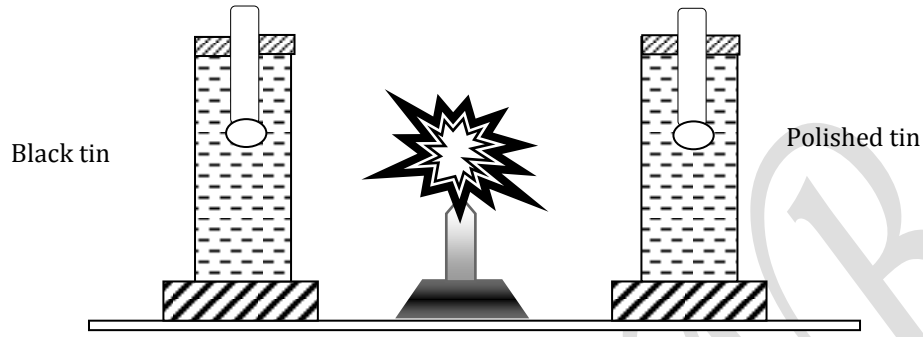
(d) Thermometer

88. (a)radiation
(b)(i)Tin B

(ii)Because it has recorded a higher temperature showing that it has a black surface which is a good absorber of radiant heat.

(c)black painted objects are good absorbers of heat than silvery shiny objects which reflects.

(d) Two smooth tins of equal size, one painted black and the other one is with the polished surface. The tins are filled with equal volume of cold water and a thermometer is placed in each tin. The thermometer is supported with a lid. Measure the initial temperature. The tins are placed a short distance from each other and a Bunsen burner is placed midway between them as shown below.



Observe the temperature registered by the thermometer for several minutes. The thermometer in a black tin shows a higher temperature than in a polished tin. This simply shows that black surfaces are good absorbers of radiant heat than polished surfaces.

---

89. (a)copper is a good conductor of heat hence it will conduct heat quickly from the flame to the food. Plastic on the other hand is a poor conductor of heat so it will prevent the user form getting burnt when holding the saucepan.

(b) A plastic cup is bad conductor of heat and it reduces heat loss when the water is being boiled. A metal cup on the other hand is a good conductor of heat hence conducting some heat away to the surrounding.

(C) So that the convection current is easily set up hence heating the water quickly.

(d) The lid prevents the setting up of the convection currents in the surrounding air and hence rapid cooling of the contents in the air.

---

90. (a)(i)conduction

(ii) Convection

(iii) Convection

(iv) Convection

(v) Conduction

(b)(i) When a material is heated at one end the molecules there gains energy and starts to vibrate Vigorously. The neighbouring molecules which are linked or close to each other also start to vibrate and this process carries on until all the molecules of the material vibrate. In this way heat energy is transferred from one end to the other end of a material.

(ii) Convection is the transfer of heat by the movement fluids. For example, when a tank of water is heated at the bottom, the temperature of the water there rises and the water becomes less dense than those above. As such the hotter water starts to rise and the cooler water also starts to sink to the bottom. This sets up a convection current which transfers heat throughout the entire body of water.

(iii) Radiation consists of electromagnetic waves which can propagate through a vacuum. On striking a body these waves are partly reflected and partly absorbed, and can cause a rise in temperature.

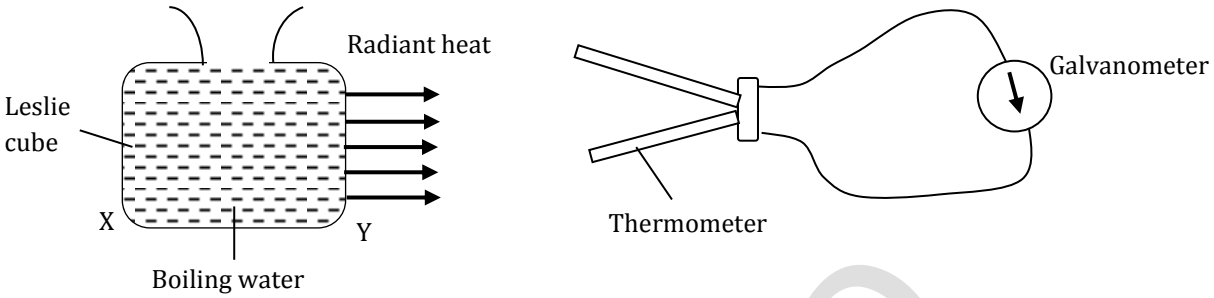
---

91. (i)the iron bar is a poor conductor of heat so it conducts heat away at a slower rate than copper which does so Fast.

(ii) Since iron is a poor conductor of heat it conducts heat much slower than copper and that iron has a higher Heat capacity so it needs longer time to heat up as compared to copper which has a lower heat capacity.

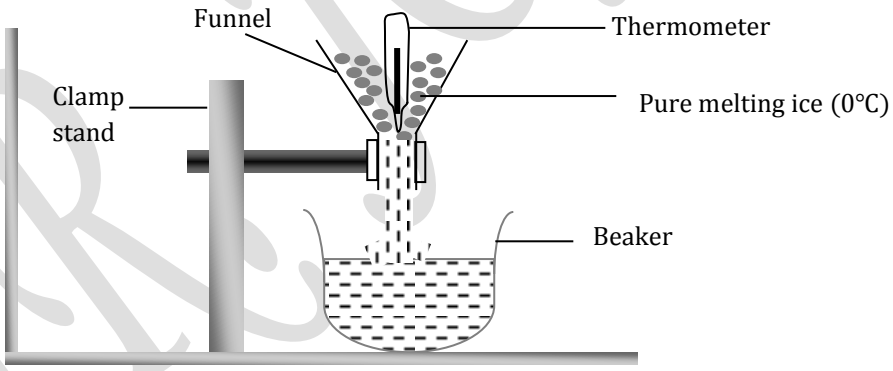
(b) a Leslie cube is used in this experiment .one vertical face X is darkened using a candle flame, while the opposite face Y is highly polished silvery bright. the cube is filled with boiling water .a thermopile is then

placed close to the cube .the cube is now turned round so that the X and the Y is in front of the thermopile which collects the radiation and the steady deflection in the galvanometer is noted as shown below.



It will be shown that the thermopile registers a greater deflection when facing the dark surface than when facing the polished surface .this shows that dark surfaces are better emitters of heat radiation.

92.)(i) Lower fixed point is the melting point of pure ice at standard atmospheric pressure. Lower fixed point is marked °C on the centigrade scale. Sometimes the lower fixed point is referred to as ice point.
(ii) Upper fixed point is the temperature of steam from pure boiling water at standard atmospheric pressure. The
upper fixed point is marked 100°C on the centigrade scale and it is sometimes referred to as steam point.
(b) To determine the lower fixed point of the pure ice, the bulb of the unmarked thermometer is placed in the glass funnel filled with pure melting ice (0°C) or ice flakes.A beaker is placed below the funnel so that it catches water from the melting ice. The mercury thread contracts rapidly down to a certain level and remain constant for some time. When it remains constant for some time, the level is marked(0°C), this is the lower fixed point as shown in the diagram below.



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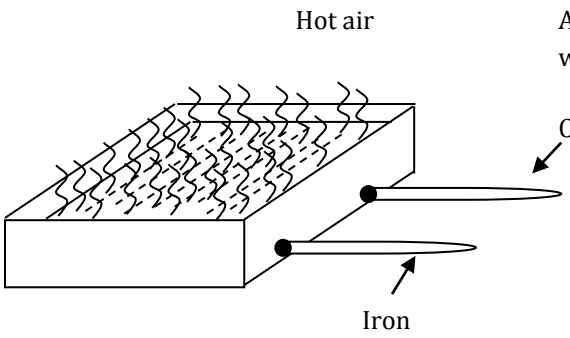
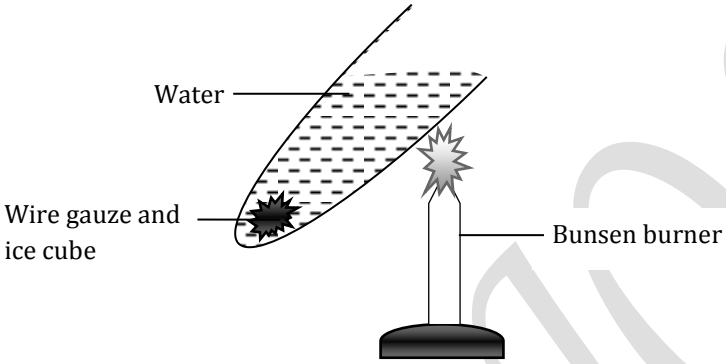
93. (a)to increase the sensitivity of a thermometer so that it can measure small changes in body temperature
(b)for easy or quick conduction of heat to mercury.
(c)to prevent the backflow of mercury in the bulb when it is removed from a patient's mouth or armpit.
(d)to measure a small range of temperature and also to give the thermometer more precision and accuracy.
(e)to magnify the thin capillary of the thermometer.
(f)to transfer heat quickly.

---

94. (a) Copper and iron rods are first dipped into molten wax and withdrawn so that a layer of wax solidifies on each one of them. They are then inserted into the trough in such a way that equal lengths of their ends stick out into the trough. Boiling water is then poured into the trough so the ends of the rods are both heated to the same temperature. After some time the wax melts to different lengths along the copper and iron rod showing that they have different thermal conductivities. It is noticed that wax has melted much greater on a copper rod than on the iron rod ,this clearly shows that copper is a better conductor of heat than iron as shown below.



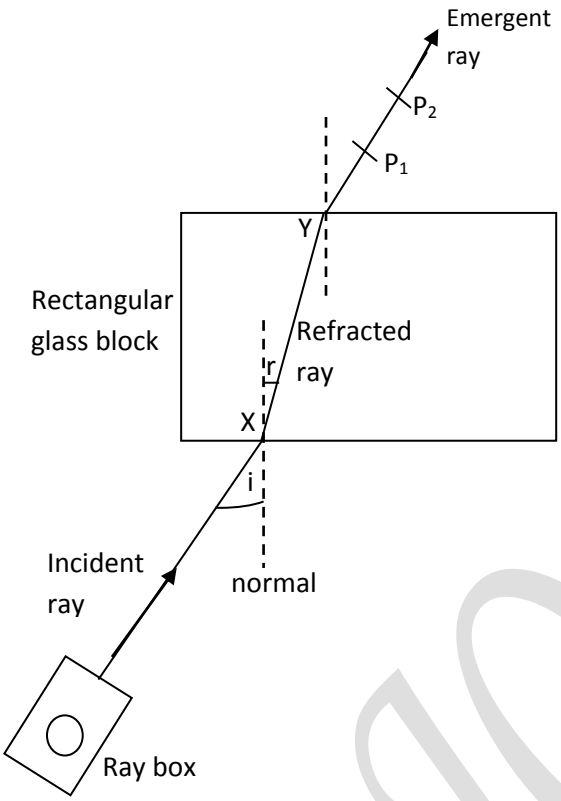
(b)an ice cube rapped in a piece of wire gauze is placed at the bottom of a test tube filled with water as shown below



It will be observed that even when water at the top of the test-tube begins to boil at 100^{o}c, the ice cube at the bottom does not melt immediately. This shows that the heat has not been conducted through the water to reach the ice cube indicating that water is poor conductor of heat.

(c)(i)1.Both results in change of phase from liquid to gaseous.
2.They are both the state change from liquid to a gas.
(ii)1. Evaporation only takes place at the surface of a liquid while boiling takes place within the entire liquid.
2. Evaporation does not involve the production of bubbles whereas boiling does.
3. Evaporation occurs at a temperature below the boiling point while boiling occurs at 100^{o}c.

95. A rectangular block is placed on a sheet of white paper and its outline traced with a pencil as shown below



It is removed and a normal line through a point X is drawn. the glass block is adjusted so that the incident ray is directed to point X with $i = 30^0$ .the emergent ray is marked with two pencil crosses P_1 and P_2 .the glass block is removed and the path of the light ray is completed with a pencil as shown in the diagram. Repeat the experiment with various values of i and tabulate the readings as shown below

i	r	Sin i	Sin r	n =sin i/sin r
30^0				
40^0				
50^0				
60^0				
70^0				

Plot a graph of sin i against sin r .the gradient of the graph is the refractive index.

96.

(a)unchanged.
(b)decreased
(c)increased
(d)increased

MACHINE

97. (i) $w = F.d$

$w = 400 \times 2$

$\underline{\boldsymbol{w = 800J}}$

(ii) $w = F.d$

$800 = F \times 4$

$\frac{4f}{4} = \frac{800}{4m}$

$\underline{\boldsymbol{F = 200N}}$

Since there is no friction therefore work done =work output

98. (a)(i) Mechanical advantage is a ratio of the load to the effort.

(ii) Velocity ratio is the ratio of distance moved by the effort to the distance moved by the load. Or the ratio of effort to load.

(iii) Efficiency of a machine is the ratio of energy output to the energy input expressed as a percentage.

(b)(i) Weight of the load.

Data
M= 60kg
g= 10N/kg
w=?

$w = mg$

$w = 60\cancel{kg} \times 10N/\cancel{kg}$

$\underline{\boldsymbol{w = 600N}}$

(ii) Energy output.

$w = F.x \qquad since\ w = E_p$

$E_p = mgh$

$E_p = 60kg \times 10N/kg \times 1m$

$\underline{\boldsymbol{E_p = 600J}}$

Efficiency

$E = \frac{energy\ input}{energy\ output} \times 100\%$

$E = \frac{600J}{800J} \times 100\%$

$\underline{\boldsymbol{E = 75\%}}$

Energy input = **800J**

(iii) The mechanical advantage

$Eff = \frac{M.A}{V.R}$

$75\% = \frac{M.A}{6} \times 100\%$

$\frac{75\%}{1} = \frac{100\%MA}{6}$

$\frac{100\%MA}{100\%} = \frac{450\%}{100\%}$

$\underline{\boldsymbol{MA = 4.5}}$

Data
V.R=6
Eff=75%
M.A=?

99. (a)(i) Energy output is the total energy that is used by the machine to do work.

(ii) Energy input is the total energy that is

(b)(i) $w = E_p = mgh$

$w = mgh$

$w = 200kg \times 10N/kg \times 6m$

$w = 12000Nm$

$\underline{\boldsymbol{w = 12000J}}$

Data
M=200kg
g=10N/kg
h=6m
w=?

(ii) $Eff = \frac{energy\ output}{energy\ input} \times 100\%$

Data
E.o= 12000J
E.n= 20,0000J
Eff= ?

$eff = \frac{12000J}{20000J} \times 100\%$

$\underline{\boldsymbol{eff = 60\%}}$

(iii) It would lose some of energy in form of sound and heat due to friction in its moving parts.

100. (a)(i) Effort is the force that overcomes the load.

(ii) Load is the force that is overcome by the effort.

(b)(i) $w = Fx$

$w = 300N \times 10m$

$w = 3000N.m$ $\quad$ ***But*** $\mathbf{1N.m = 1J}$

$\therefore \boldsymbol{w = 3000J}$

Data
F=300n
x=10m
w=?

(ii)

Data
Load =300N
Effort = 200N
MA =?

$M.A = \frac{L}{E}$

$M.A = \frac{300\cancel{N}}{200\cancel{N}}$

$\boldsymbol{M.A = 1.5}$

(iii)

Data
Distance moved by effort= 40m
Distance moved by load= 10m
Velocity ratio=?

$V.R = \frac{distance\ moved\ by\ effort}{distance\ moved\ by\ load}$

$V.R = \frac{40m}{10m}$

$\boldsymbol{V.R = 4}$

(iv) $E_p = mgh$

$E_p = w = Fx$

$E_p = Fx$

$E_p = 200N \times 40m$

$E_p = 8000N.m$

$\boldsymbol{E_p = 8000J}$ $\quad$ ***since*** $\mathbf{1N.m = 1J}$

(v)

Data
Eff=?
E.O=3000J
E.I=8000J

$eff = \frac{E.O}{E.I} \times 100\%$

$eff = \frac{3000J}{8000J} \times 100\%$

$\boldsymbol{eff = 37.5\%}$

Or

$eff = \frac{M.A}{V.R} \times 100\%$

$eff = \frac{1.5}{4} \times 100\%$

$\boldsymbol{eff = 37.5\%}$

(vi)

Data
m=?
w=300N
g=10N/kg

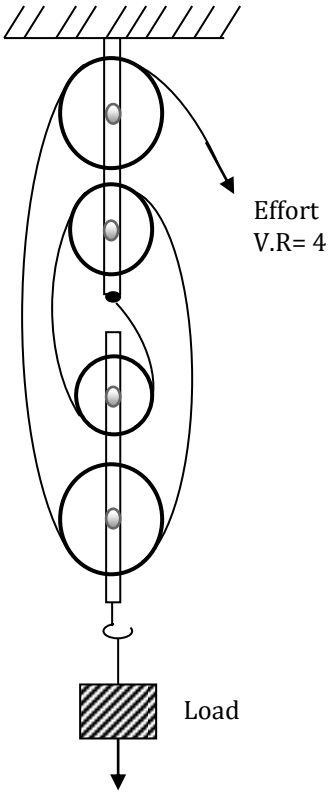
$w = mg$

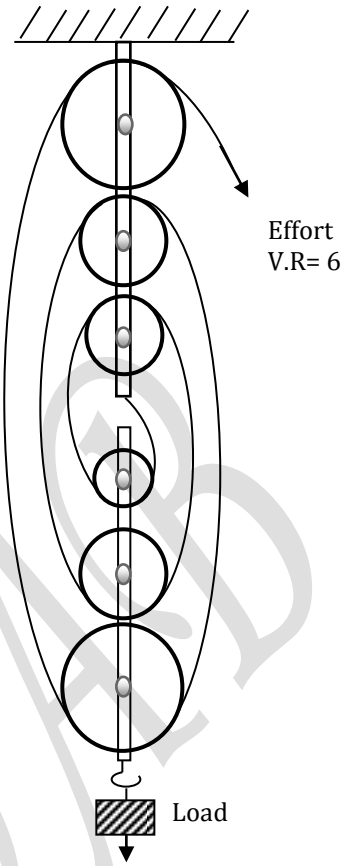
$300N = m \times 10N/kg$

$\frac{\cancel{10N/kg}m}{\cancel{10N/kg}} = \frac{300\cancel{N}}{10\cancel{N}/kg}$

$\boldsymbol{m = 30kg}$

101. (i)





Note: *For the pulley system, the velocity ratio (V.R) is equal to the number of ropes around the rims and it is equal to the number of rims In the system.*

(b) (i) $V.R = No.of\ ropes\ around\ the\ rims$

$\underline{= \mathbf{2}}$

(ii) $eff = \frac{M.A}{V.R} \times 100\%$

$75\% = \frac{M.A}{2} \times 100\%$

$\frac{75\%}{1} = \frac{100\%\ M.A}{2}$

$\frac{\cancel{100\%}\ M.A}{\cancel{100\%}} = \frac{150}{100\%}$

$\underline{\boldsymbol{M.A = 1.5}}$

(iii) $M.A = \frac{L}{E}$

$\frac{1.5}{1} = \frac{120N}{E}$

$\frac{\cancel{1.5}E}{\cancel{1.5}} = \frac{120}{1.5}$

$\underline{\boldsymbol{E = 80N}}$

(iv) $w = E_p = mgh$ *and mg in* E_p *gives weight w=mg*

$w = w.h$

$w = 80N \times 0.5m$

$\underline{\boldsymbol{w = 40N}}$

(v) $eff = \frac{E.O}{E.I} \times 100\%$

$75\% = \frac{40J}{E.I} \times 100\%$

$\frac{75\%}{1} = \frac{4000J.\%}{E.I}$

$\frac{\cancel{75\%}\ E.I}{\cancel{75\%}} = \frac{4000J.\%}{75\%}$

$\underline{\boldsymbol{E.I = 53.33J}}$

∴ Energy wasted is the difference between E.I and E.O

Energy wasted $= 53.33J - 40J$

$\underline{= \mathbf{13.33J}}$

(vi) Because some of the energy is wasted in form of sound and heat due to friction in overcoming (pulley) the load.

---

102. (a) $V.R = \frac{No.of\ teeth\ on\ driving\ wheel}{No.of\ teeth\ on\ driving\ wheel}$

$V.R = \frac{18}{9}$

$\underline{\boldsymbol{V.R = 2}}$

(b) $eff = \frac{M.A}{V.R}$

$\frac{80}{1} = \frac{M.A}{2}$ $\underline{\boldsymbol{M.A =}}$

$\underline{\mathbf{160}}$

(c) Let 36 teeth → 15 rotation and 12 teeth → x

36—— 15

12—— x

$\frac{\cancel{36}x}{\cancel{36}} = \frac{180}{36}$

$x = 5$

∴ Driving wheel = 5 rotations

LIGHT

103. (i) Converging lens
(ii) Converging lens
(iii) Converging lens
(v) Converging lens

---

104. (a) (i) Refraction is the bending of light rays when they pass at an angle from one medium to another medium of different optical densities.

(ii) Refraction index of a medium is the ratio of sin ***i.*** ($n = \frac{sin\ i}{sin\ r}$)

(b) $n = \frac{\sin i}{\sin r}$

$\frac{1.5}{1} = \frac{\sin 60}{\sin r}$

$\frac{1.5 \sin r}{1.5} = \frac{\sin 60}{1.5}$

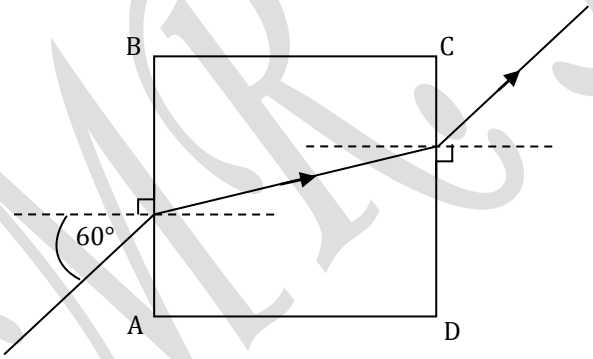
$\sin r = 0.541265877$

$r = sin^{-1}(0.541265877)$

$r = 35.3°$

$\boldsymbol{r = 35°}$

(c)



(d) Because when the ray enters the block from the side AB it reduces its speed hence bending towards the normal

making it impossible to emerge from the side BC

---

105. (a) (i) Reflection is the bending of light when it strikes a medium.

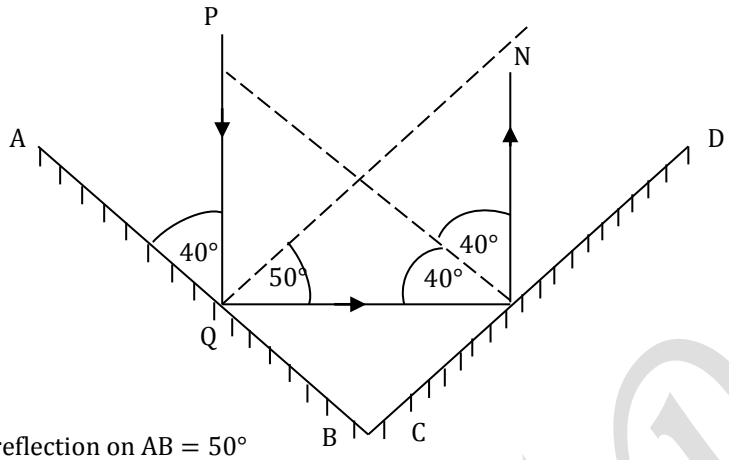
(ii) 1. The angle of incidence is equal to the angle of reflection

2. The incident ray, reflected ray and the normal all lie in the same plane.

(b) (i) Angle of incident $= 90° - 40°$

$\boldsymbol{= 50°}$

(ii)



(iii) - Angle of reflection on AB = 50°
- Angle of incidence on CD = 40°
- Angle of reflection on CD = 40°

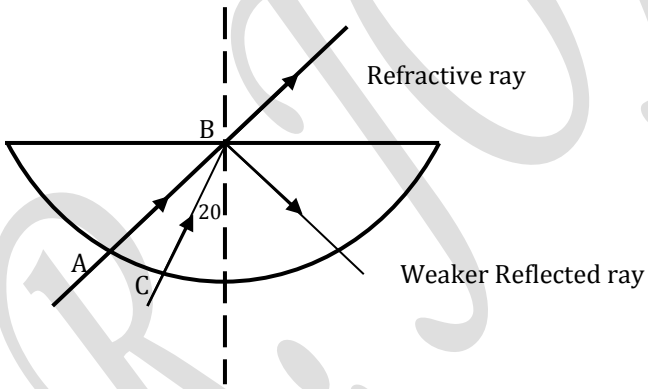
(iv) They are parallel to each other.

---

106. (a) Because of the curvature (curved boundary) of the surface the ray make a 90o angle of incidence making it not to bend or change direction.

(b) Since the angle of incidence is greater than the critical angle of the glass block, the surface of the glass block acts like a perfect mirror hence reflecting a ray instead of refracting it.

(d)



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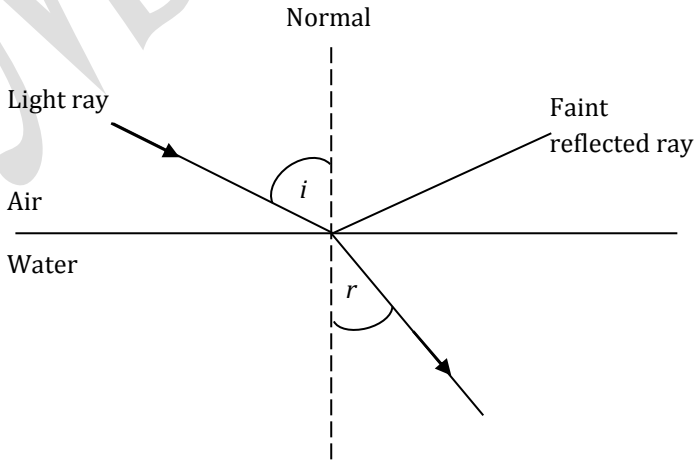
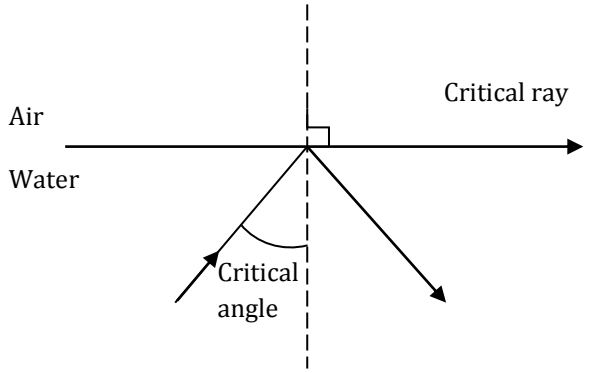
107. (a) (i) Refraction is the bending of rays of light when they pass from one medium to another of different optical density, for example air into water.



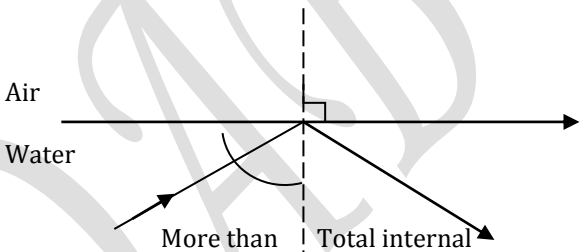
(ii) Refractive index is $\frac{\sin i}{\sin r}$ where i is the angle of incident and r is the angle of refraction. Refractive index has no units since it is a ratio.

(iii) Critical angle is the angle of incidence when light emerges from an optical denser medium at an angle of refraction of90°.



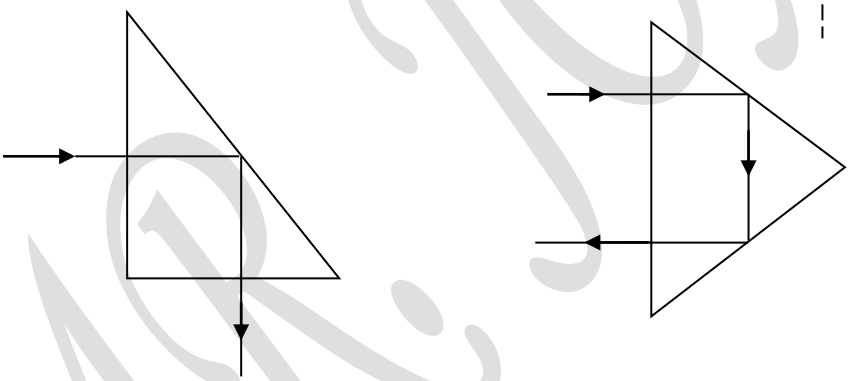
(iii) Total internal refraction occurs when the angle of incidence is bigger than the critical angle. Light is completely reflected at the surface of denser medium.

Note Total internal reflection occurs only when a light passes from a denser medium into a less dense medium.



(b) (i) Through 90°

(ii) Through 180°



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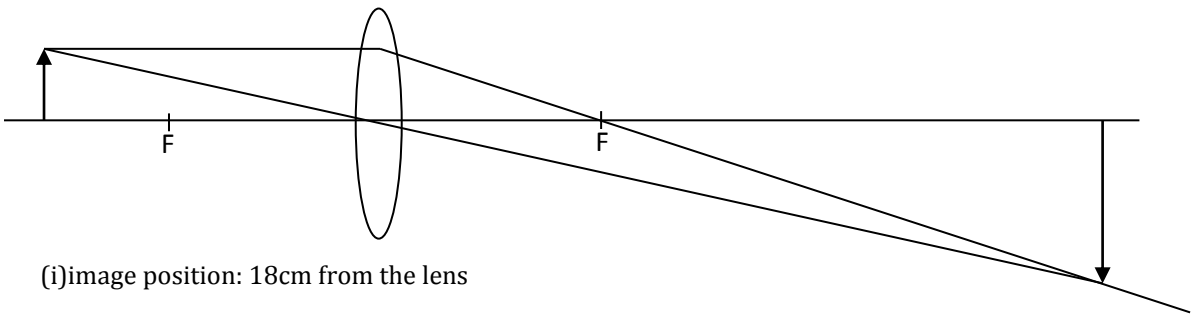
108. (a) Lens X
(b) Lens Y
(c)(i) is the point from which the rays appear to diverge (spread out)
(ii) is the distance between the centre of lens and the principal focus (F).
(iii)
(d)(i) Projector
(ii) Camera

109. (a)scale:1cm to represent 2cm on graph paper.

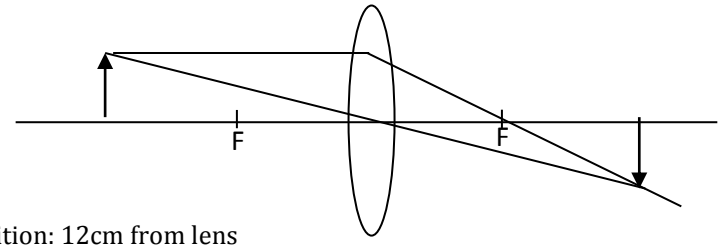


(i)image position: 18cm from the lens

(ii)height: 4cm

(iii)type: real and inverted

(b(i))scale:1cm to represent 2cm.

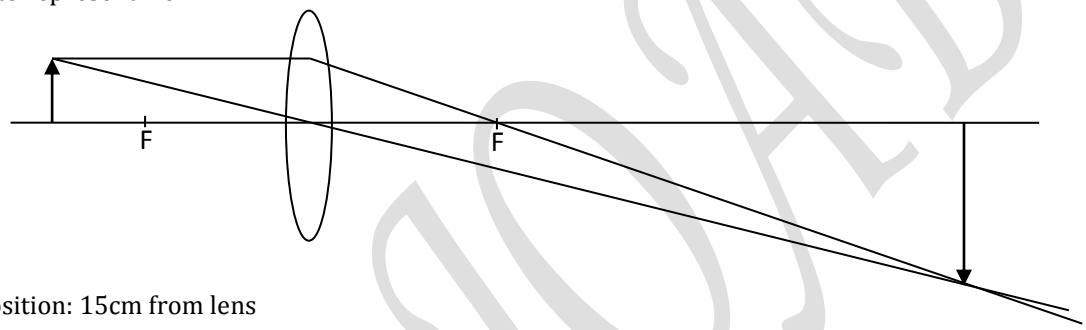


Position: 12cm from lens

Height: 2cm

Type: real and inverted

(ii)1cn to represent 2cm.



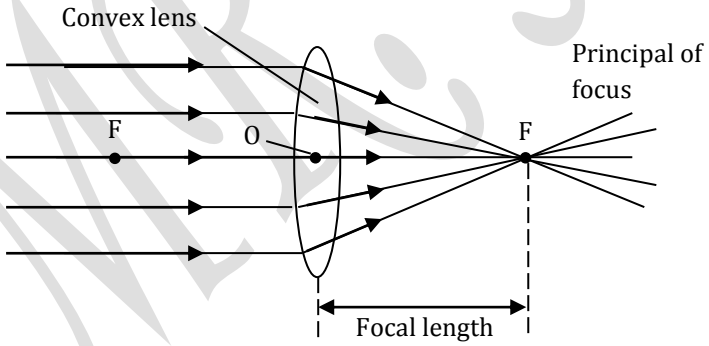
Position: 15cm from lens

Height: 3cm

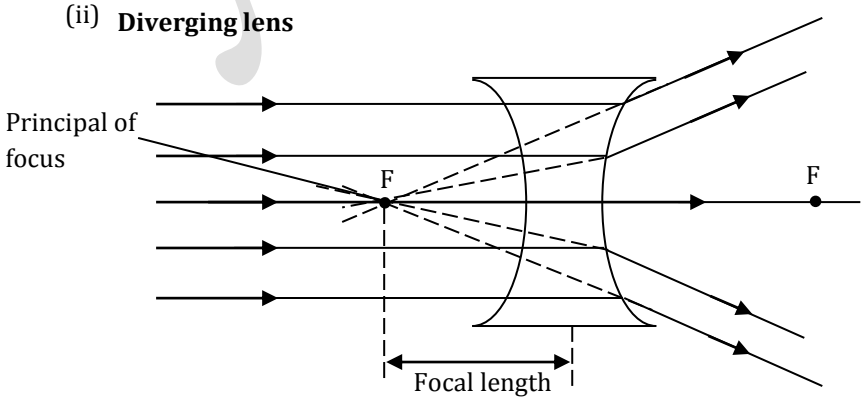
Type: real and inverted.

---

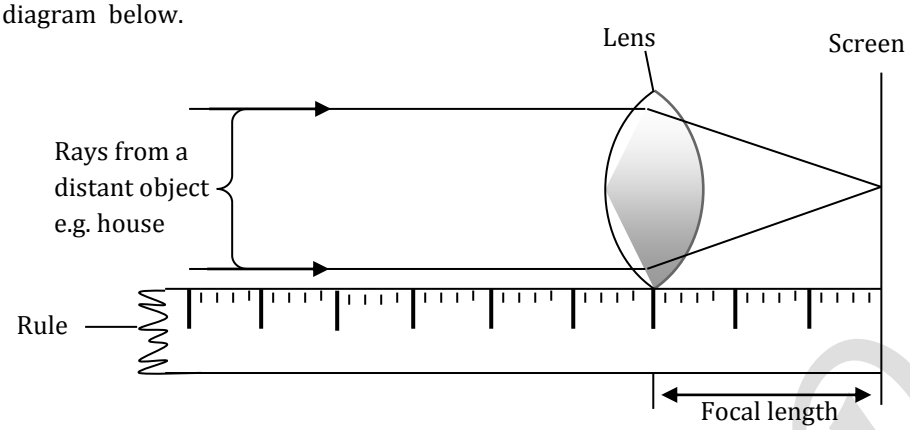
110. (a) (i) **Converging lens**



(ii) **Diverging lens**



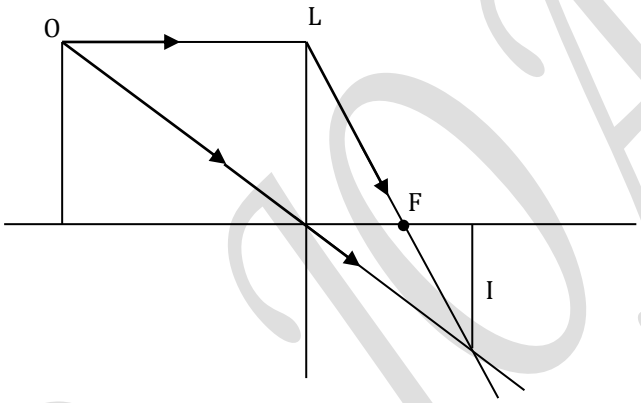
(b) Place a lens in front of a window, and place a white screen on the other side of the lens as shown in the diagram below.



More the white screen to and fro until a sharp image of the scenery outside the window is formed on the screen. The distance between the lens and the screen is the focal length.

---

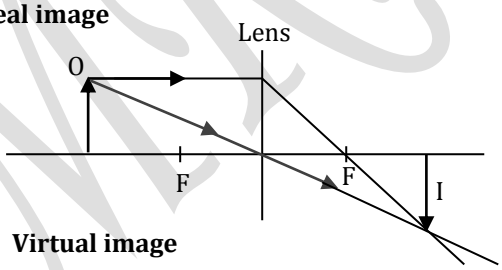
111. (a)



(b)(i) Real
(ii) Diminished
(iii) Inverted

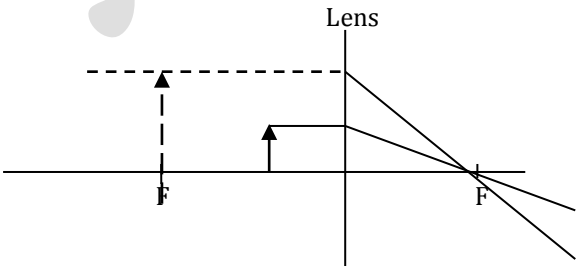
(c)(i) Virtual image is the one which cannot be caught on a screen.
(ii) Real image is the one which can be projected on the screen.

(d) **Real image**



Note: ***To produce a real image, the object distance must be greater than the focal length of lens***

Virtual image



Note: To obtain a virtual image, the Object Distance must be less than the focal Length of the lens

---

112. (a) Q = it
= 4 x 1
= 4C

(d) Q = it
5 = 4t
4 4
t= 1.25s

or

since Q = It, therefore
E= VIt
E = 12 X 4 X t
60 = 48t
48 48
t= 1.25s

---

113. (a) Resistance = $\frac{voltage}{current}$

R = $\frac{V}{I}$

(b) (i) Data
V = 12V
I = 2A
R = ?
R = $\frac{V}{I}$
R = 12V / 2A
R = 6V/A
thus, R =

(ii) Data
V = 50V
R = 10Ω
I = ?
I = $\frac{V}{R}$
I = 50V / 10Ω
I = 5V/Ω
I = 5A

(iii) Data
V?
I = 3.0A
R = 4Ω
V = IR
V = 3.0A x 4Ω
V = 12V

---

114. (a) $R_T = R_1 + R_2 + R_3$
R_T = 4Ω + 6Ω + 8Ω
R_T = 18Ω

(b) V = IR
3.6V = I x 18 Ω
18 18
I = 0.2A

(c) (i) voltage across 4Ω
$V_1 = IR_1$
V_1 = 0.2 x 4Ω
V_1 = 0.8 V

(ii) voltage across 6Ω
$V_2 = IR_2$
V_2 = 0.2A x 6Ω
V_2 = 1.2 V

(iii) voltage across 8Ω
$V_3 = IR_3$
V_3 = 0.2A x 8Ω
V_3 = 1.6 V

Comment on answers on C (i) ,(ii) & (iii)
The answers in(i), (ii) and(iii) confirms that when the value of resistance is different the value of voltage is also different and must be equal to be total e.m.f

(d) $V_T = V_1 + V_2 + V_3$
V_T = 0.8 + 1.2 + 1.6
V_T = 3.6V

note: The sum of the individual P.d's is equal to the total e.m.f . E.m.f = $V_1 + V_2 + V_3$

115. (a) (i) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$

$1 = \frac{1}{2} + \frac{1}{3}$

R_T

$\frac{1}{R_T} = \frac{3+2}{6}$

$\frac{1}{R_T} = \frac{5}{6}$

$\frac{5R_T}{5} = \frac{6}{5}$

$R_T = 1.2\Omega$

Or

$R_T = \frac{R_1R_2}{R_1 + R_2}$ → **This formula is applicable if you have two resistors only. For more than two(2) resistors use the first formula.**

$R_T = \frac{2 \times 3}{2+3}$

$R_T = \frac{6}{5}$

$R_T = 1.2\Omega$

(ii) $V = IR$

$\frac{6}{1.2} = \frac{I\,1.2}{1.2}$

$I = 5A$

(iii) current though 2Ω

$V = I_1R_1$

$\frac{6}{2} = \frac{I \times 2}{2}$

$I_1 = 3A$

(iv) current through 3Ω

$V = I_2R_2$

$\frac{6}{3} = \frac{I_2 3}{3}$

$I_2 = 2A$

(b) In parallel connection the individual bulbs could not be affected when one is switched off while in series connection
when one bulb is switched off the rest also will be off.
Parallel connection insures all components in the circuit have the same voltage as the source as opposed to series
connection. For instance all bulbs in parallel connection have the same brightness as opposed to series connection
whose brightness of bulbs differs.

---

116. (a) $R_T = R_1 + \left(\frac{R_2R_3}{R_2+R_3}\right)$

$R_T = 1.6 + \left(\frac{4 \times 6}{4+6}\right)$

$R_T = 1.6 + \left(\frac{24}{10}\right)$

$R_T = 1.6 + 2.4$

$R_T = 4.0\Omega$

(b) $V = IR$

$\frac{12}{40} = \frac{I\,4.0}{40}$

$I = 3.0$ A

(c) (i) Voltage across AB

$V_1 = IR_1$

$V_1 = 3 \times 1.6$

$V_1 = 4.8$V

(ii) $V = IR$

$V = \left(\frac{R_2R_3}{R_2 + R_3}\right)$

$V = 3\left(\frac{4 \times 6}{4+6}\right)$

$V = 3 \times 2.4$

$V =$ **7.2V**

(d) Q = It

= 3 (1 x 60)

= 3 x 60

= 180C

(e) (i) $I_2 = \frac{V}{R}$

$I_2 = \frac{7.2}{4}$

I_2 = 1.8A

(ii) $I_3 = \frac{V}{R}$

$I_3 = \frac{7.2}{6}$

I_3 = 1.2A

---

117. (a) This means that when an electric kettle is connected to a 240V supply ,it uses 100J of electrical energy per second.

(b) Data
p = 100W
V = 2400V
I = ?

P = IV

$\frac{100}{240} = \frac{I240}{240}$

I = 0.4A

(c) $P = \frac{V^2}{R}$

$100 = \frac{(240)^2}{R}$

$\frac{100R}{100} = \frac{57600}{100}$

R = 576Ω

Or

$R = \frac{V}{I}$

$R = \frac{240}{0.4}$

R = 600 Ω

---

118. (a) This means that when an electric heater is connected to a 240V supply ,it uses 2000J of electric energy per second.

(b) $I = \frac{P}{V}$

$I = \frac{2kw\ x\ 1000k}{240V}$

$I = \frac{2000}{240}$

I = 8.3A

(c) Number of electricity is the same as energy

No = Pt

= 2kw x 8 hrs

= 16kw/h

thus; 16 units

---

119. (a) Data
P= ?
I = 3A
V =12V

P = IV
P= 3 x 12
P = 36W

(b) $R = \frac{V}{I}$

$R = \frac{12}{3}$

R = 4Ω

120.

DATA
P = 120 X 4 security lights / 1000
P = 0.48KW
E=?

t = 30 days x 24hrs
t = 72 hrs

E = Pt
E = 0.48 x 720
E = 345. 6 kwh

Thus ;
1 unit ——— K60
345.6 unit—— x

X = K20736
Energy cost = K 20736

---

121. (i) It is included so that when a fault develops and too much current flows, it blows off and breaks circuit connection to disconnect the power so that the cable cannot overheat and catch fire.

(ii) So that the earth wire can transmit the current to the ground in case of a leakage of current from the wire to the casing.

(iii)

DATE

P = 2000W / 1000K

P = 2KW

t = 0.1hrs

E= ?

E = pt

E = 2 x 0.1

E = 0.2kwh

thus

1 Kwh ——— 3600000J

0.2kwh _____ x

X kwh / Kwh = 720000kwh.J / Kwh

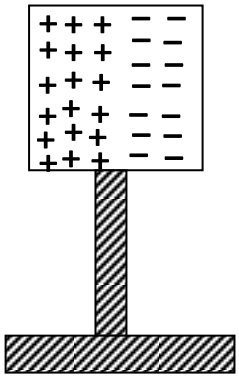
X = 720000J

E= 720000J

NOTE: on (iii) current 2000W to KW and 6minnutes to hours.To find energy in joules just convert 0.2kwh to joules.

---

122. (a)



(b) Since the can has positive and negative charges therefore the positive charges makes to be attracted to the rod.

(c) From the can to be ground through the person touching the can.

(d) Positive charge.

---

123. (i) insulator

(ii)

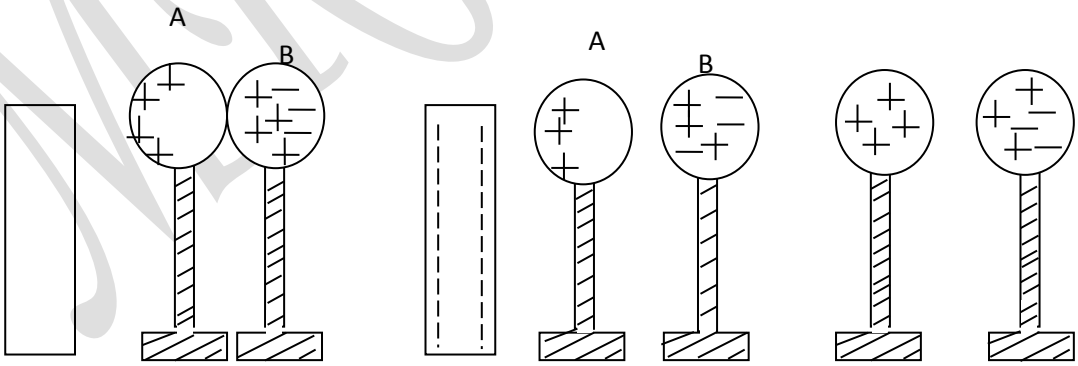


figure 1 figure 2 figure 3

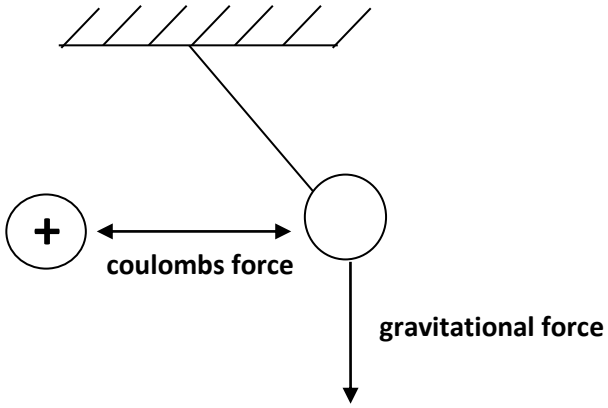
124.(a) 1. Used in electrostatic filters in coal fired power station / plants

2. Used in photocopying machines

(b) (i) (a) Because C is positively charged ,hence inducing a convergence in space thereby attracting S

(b) Due to electrostatic induction S because positively charged hence repelled after touching the surface of C

(ii)



(iii) This happens because the Bunsen flame induces a negative charge on S as a result due to coulomb's force S is attracted to C

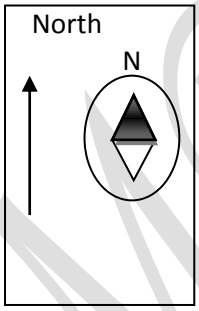
MAGNETISM AND ELECTROMAGNETIC INDUCTION

125. (a) Bars 1 and 3 are permanent magnets.
Bar 2 is not a permanent

(b) (i) 1. Iron
2. Steel
3. Nickel

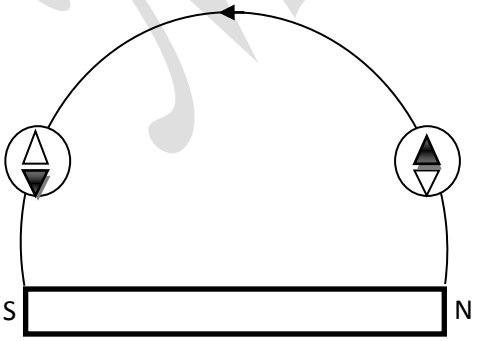
(ii) 1. Copper
2. Aluminum
3. Wood

126. (a)



Note: The N of the compass points to the north because the earth's magnetic fields are vertical, hence no effect on the compass needle.

(b)

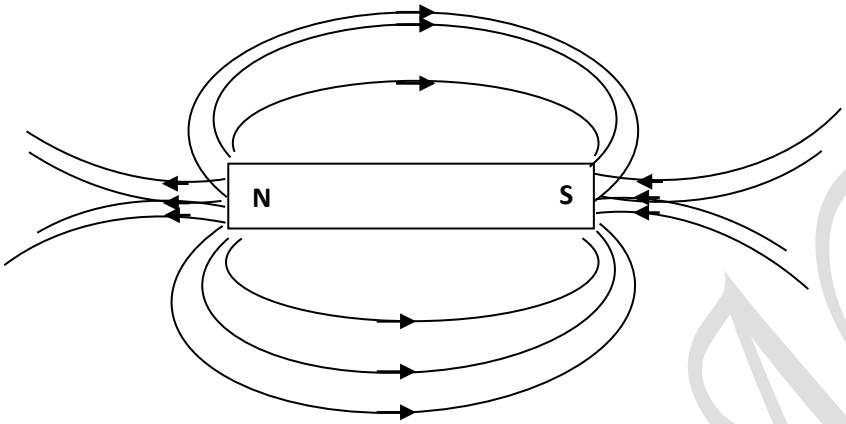


Note: North of compass is attracted to S of the magnet

(c) Position X :

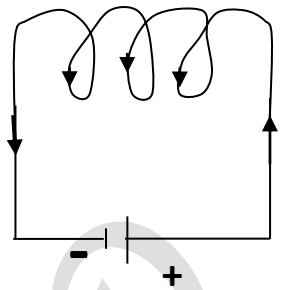
Note:(C) Magnetic field lines are concentrated at the poles, hence the stronger field

(d) The compass needle is used to plot the magnetic field lines .The needle is placed near one end of the magnet and pencilled dots are made to marks the position of the needle .Then the compass is moved so that its needle lines up with the previous dots and so on. When the dots are joined p, the result is a magnet field line .The compass needle can be moved to a different position so that more field lines are made as shown below.



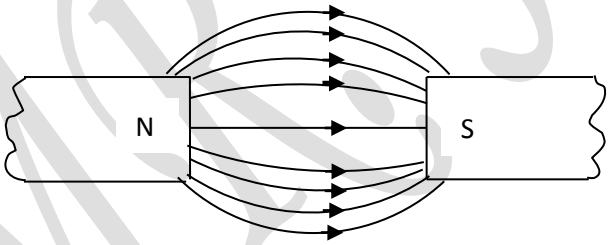
127. (a) 1. Increasing current
2. Increasing the No of turns on the coil
(b) by reversing the current (changing the direction of current)

(c)



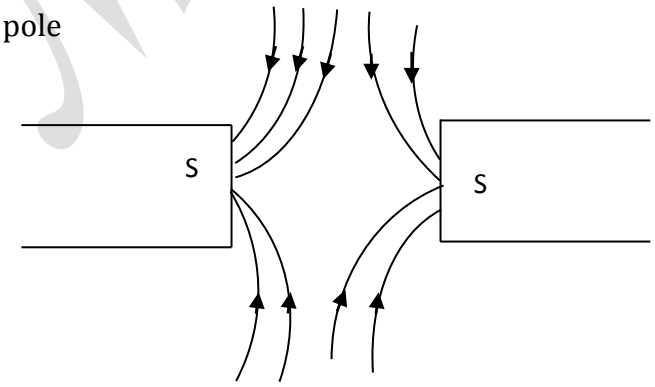
Note: Use right -hand grip rule to find the S and N poles.

(d)



(e) (i) North pole

(ii)



128. (a) To create a temporal and stronger magnetic field
(b) Because iron makes a temporal magnet, hence it is used instead of steel which makes a

permanent magnet.

(c) 1. Increasing current.

2. Increasing the number of turns in the coil.

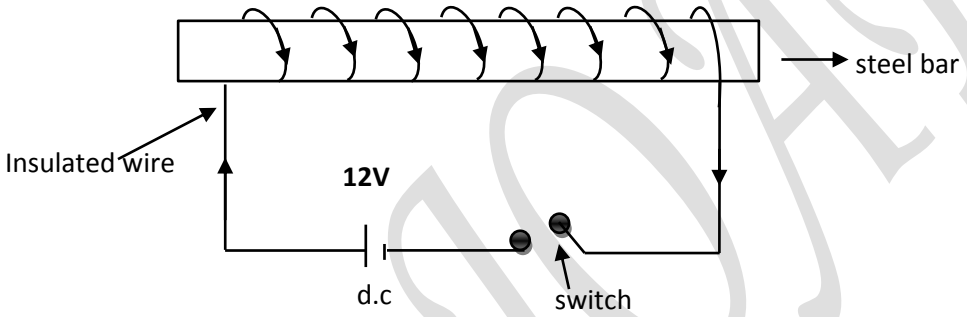
129.(a) 1. Heating a magnet to red hot.

2. Hammering

3. Dropping it several times on a hard ground

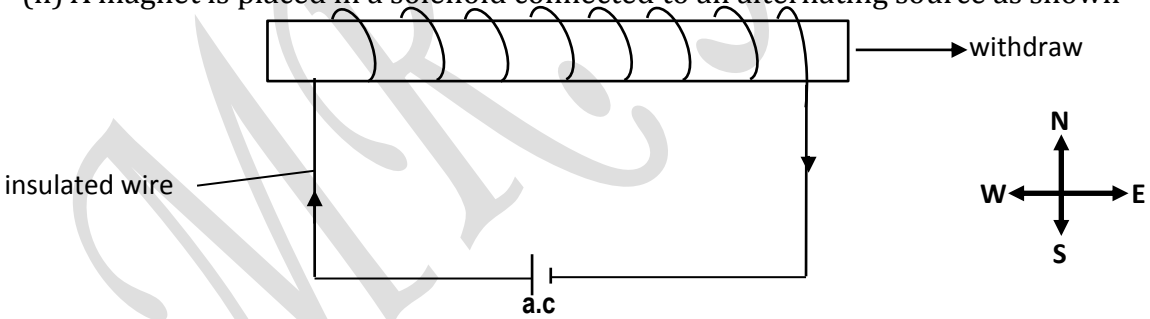
(b) Stroking method

(c) (i) A solenoid, made with at least 500 turns of insulated copper wire is connected in series with a 12 V electric battery as shown below.



The given steel bar is placed inside the coil and the current is switched on and off. On remaining it, the bar can be tested to show that it is magnetized.

(ii) A magnet is placed in a solenoid connected to an alternating source as shown



The current is switched on and the magnet is slowly withdrawn from the solenoid to a distance of several

Meters from the solenoid as shown above .The magnet is now demagnetized.

(d) (i) Because a.c produces a continuously changing field which demagnetizes the bar magnet.

(ii) D.C creates a constant magnetic field which magnetizes the iron.

130.(a) Each nail becomes magnetized due to the presence of the permanent magnet .The top end of a nail is the

N - pole while the bottom part is the S-pole. Since unlike poles attract, the nails become attracted to the Magnet.

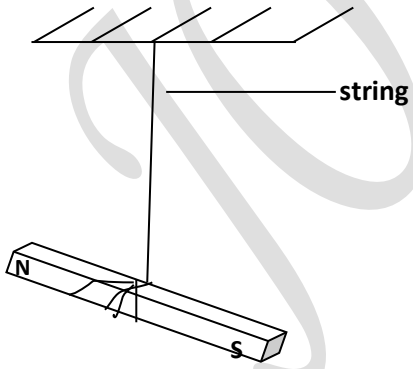
(b) (i) Steel ,because it makes a permanent magnet.

(ii) Iron, the core must be easily magnetized and demagnetized.
(iii) Iron, magnetism must be temporary.
(iv) Iron, magnetism must be temporary
(v) Iron, the shield must be able to concentrate and direct the field away from the protected object.

(c) Iron is easily magnetized while steel is difficult to magnetize.
Iron is easily demagnetized whereas steel is difficult to demagnetize.
Iron does not retain its induced magnetism for a long time while steel does.
Iron makes a temporary magnet while steel makes a permanent one.

131.(a) an experiment to show that a magnet has two different types of poles (N & S)
when the North pole of a magnet is brought near to the North pole of another magnet which is having freely in the North pole of a suspended magnet moves away. This shows that like poles repel. However when the South pole of another magnet is brought near the North pole of the suspended magnet, the North pole of the suspended magnet moves towards the South pole .This shows that unlike poles attract. The observation shows clearly the existence and the two different types of poles .

(b) an experiment to show that a magnet can act as compass
When a magnet is suspended freely in the air with the aid of stringy cones to rest pointing to N - S direction as shown below



to the North pole points to the South pole points to the South point of the Earth ,hence it can act a compass .

(c) Experiment to show that magnetic properties are concentrated at the poles
place a magnet flat into a tray of iron filings and after a while ,take at the magnet ,It is observed that iron fillings cling around the poles ,of the magnet. This shows that, magnetic properties are concentrated at the poles.

(d) Experiment to show that a magnet is surrounded by a magnetic field
place five compasses in a circular manner the points of all the compasses point towards the same direction .Then ,place a magnet in the centre of the circle as shown. Now ,each of the pointer points in a different direction. This shows that , the magnet has a magnet has a magnetic field surrounding it which after the compasses.

MUTUAL INDUCTION (TRANSFORMER)

132. (a) Step up transformer
Step down transformer

(b) (i) $v_p i_p = v_s i_s$

$\frac{24 \times 0.15}{0.2} = \frac{V_2 \times 0.2}{0.2}$

$V_2 = 18V$

(ii) $P = V_2 I_2$

$P = 18 \times 0.2$

$P = 3.6W$

(iii) Step down transformer: because its primary coil has higher voltage than the secondary coil.

(c) When an alternating current (charging current) is applied to the terminals of the primary coil and allowed to Pass through, it produces a magnetic field in the primary coil which in turn produces an alternating magnetic flux linking the secondary coil. This produces an induced e .m. f in the secondary coil due to electromagnetic Induction, hence, varying voltage.

---

133. (a) $\frac{V_P}{V_S} = \frac{N_P}{N_S}$

$\frac{240}{12} = \frac{12000}{N_S}$

$\frac{240N_S}{240} = \frac{14400}{240}$

$N_S = 600$ turns

(b) $V_P I_P = V_S I_S$

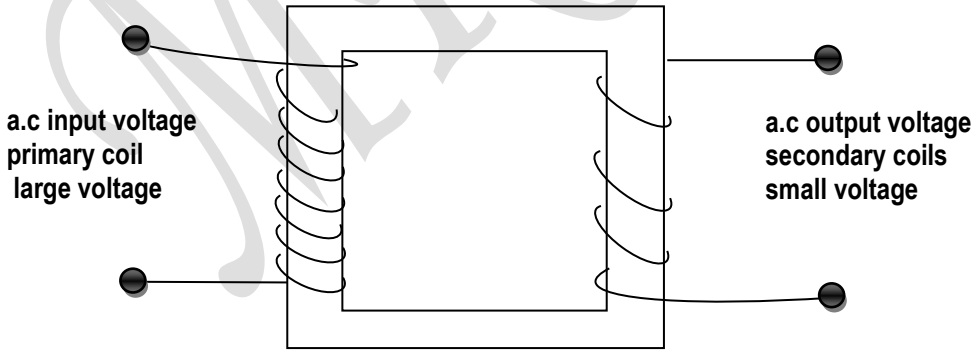
$\frac{240 \times I_P}{240} = \frac{24}{240}$

$I_P = 0.1A$

(c) (i) Secondary coil

(ii) Because it's carrying a larger voltage

(d) The transformer that reduces voltage is a step down transformer.
It has fewer turns of wire on the output coil than on the input coil.
It has small voltage in the output than on the input
The diagram below shows this kind of a transformer



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134. (a) (i) $V_P I_P = V_S I_S$

$240 \times I_P = 12 \times 5$

$\frac{240I_P}{240} = \frac{60}{240}$

$I_P = 0.25A$

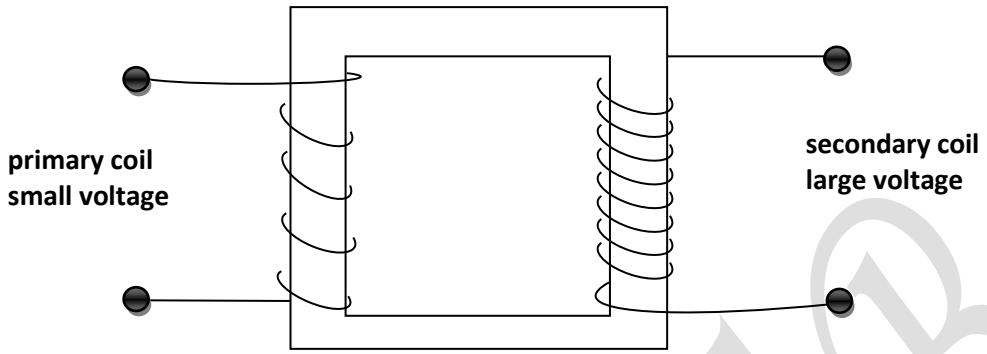
(ii) $P_P = V_P I_P$

$P_P = 12 \times 5$

$P_P = 60W$

(iii) **$P_S = 60$ W** since there is no power loss

(b) The transformer that increases voltage is a step up transformer .
It has few turns of wire on the primary coil than on the secondary coil ,
It has a larger voltage on the secondary coil than on the primary coil.
Below is the structure of this type of a transformer.



(c) (i) It magnetizes easily and demagnetizes easily, hence it produces a temporal magnet needed in the transformer.
(ii) Is a good conductor of electricity .
(d) By laminating the iron core with insulated iron sheets.

---

135. (a) $V_P N_S = V_S N_P$

$$\frac{V_P \times 100}{100} = \frac{10 \times 2000}{100}$$

$$\mathbf{V_P = 200V}$$

(b) $V_P I_P = V_S I_S$

$V_S I_S$ is known to be 40W

$$\frac{200 I_P}{200} = \frac{40}{200}$$

$$\mathbf{I_P = 0.2A}$$

(c) An ideal transformer is the one whose efficiency is 100%.

NOTE: In an ideal transformer there is no loss of energy, meaning the amount of energy input is equal to the amount of energy output.

---

136. (a) Step up transformer
(b) $V_P N_S = V_S N_P$

$$12 \times 250 = V_S \times 100$$

$$\frac{3000}{100} = \frac{100 V_S}{100}$$

$$\mathbf{V_S = 30V}$$

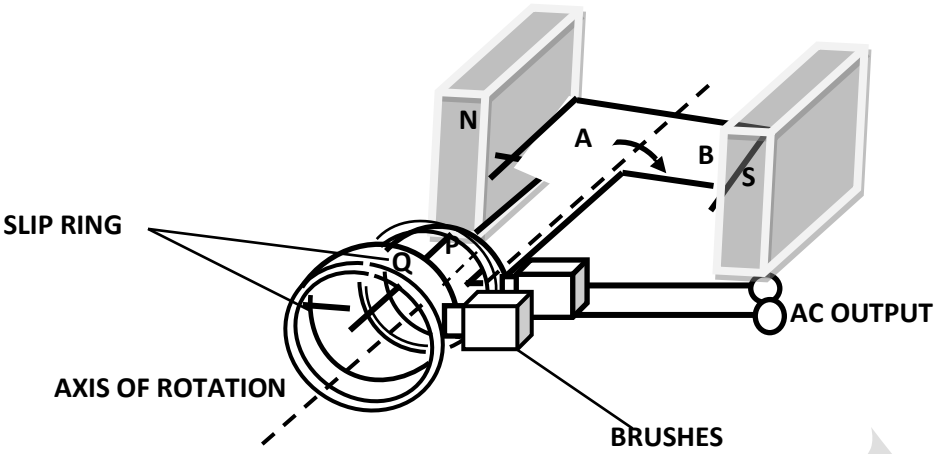
(c) A step up transformer increases voltage whereas a step down transformer decreases voltage A step up transformer has many turns of wire on the secondary coil than on the primary coil.

---

137. (a) Direct current (D.C) does not produce a charge in voltage or no voltage is induced in the output coil.
(b) To reduce the power loss by the eddy currents (unwanted currents)
(c) When the transformer increases voltage the amount of current on the out- put coil is halved and vice- versa and also that the change in current and voltage depends on the turn ratio.

---

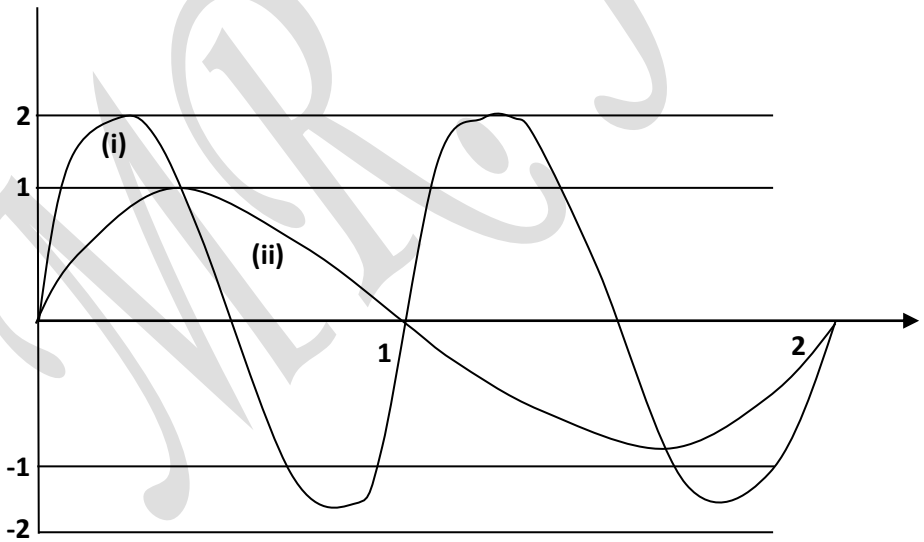
138. (a)



An a.c generator has the following main parts.

1. A permanent magnet shaped to produce a uniform magnetic field
2. A wire coil which rotates in the magnetic field to generate current (e.m.f) by electromagnetic induction.
3. Two slip rings and carbon brushes which conduct the induced current to an external circuit
   When the coil is rotating in a clockwise direction such that side A is moving upwards and side B is moving downwards the induced current flows from ring P, through the coil to ring Q. During the second half of the rotation, the direction of the induced current is reversed and flows from ring Q through the coil to ring P this reversal of direction of the current occurs every cycle which gives rise to an alternating current.

(b)



Both the frequency and the amplitude of the output e.m.f are proportional to the speed of rotation .Hence, at half the rate of rotation, the frequency and amplitude would also be halved

139. (a) 1 .By increasing current
2. By using a stronger magnet.
(b) Upwards.
(c) 1. By reversing the current.
2. By reversing the magnetic field.

140. (a)(i) Brushes
(ii) Commutator
(b) (i) **Split rings** : to make contact with the carbon brushes in order to conduct electric current from the circuit
(ii) **Brushes**: to make a continuous contact with the split rings so as to conduct electric current fro the external circuit.

141.(a) A.C ,because as the coil rotates each side moves upwards, downwards, upwards ,downwards and so on through the magnetic field thereby producing a current which flows backwards and forwards which is alternating current.
(b) 1.Rotating the coil faster
2. Using a strong magnet.
3. Increasing the number of the coil
(c) (i) Horizontal position
(ii) Because the coil is cutting the field lines.

---

142. (a) (i) A small deflection to the right.
(ii) A small deflection to the right .
(iii) A larger deflection to the right
(b) Electromagnetic induction

143.(a) (i) Deflection to one side
(ii) No deflection
(iii) Deflection in direction apposite to that in (i)

NOTE: The deflection depends on the direction of motion

(b) (i) Deflection in direction opposite to that in (a)(i)
(ii) The deflection is in the same direction as that in (a)(i) but the magnitude is greater.

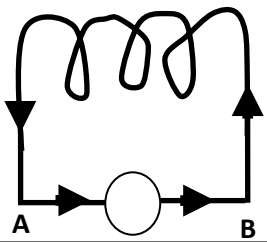
---

144. (a) South pole because the current changes the pole of the solenoid so as to oppose the magnet ,hence left is also south.

NOTE: Lenz's law

(b) AB

NOTE: The solenoid will look like this



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145. (a) When a small current is passed through the heater it gets hot and electrons are emitted from the surface of the heater.
(i) Negative (-)
(ii) The heater is heated and the electrons gains enough energy .When the electrons gains enough energy they escape from the surface of the cathode.
(iii) They are attracted to the anode since they are negatively charged.
(iv) 1. They are negatively charged.
2. They can be rubbed off certain substances using specific materials.
3. They can flow through a conductor if potential difference is applied between the two ends

(b) (i) Thermionic Emission
(ii)To acceleration the electrons
(c) (i) to deflect the beam vertically
(ii) To deflect the beam horizontally
(iii) To deflect the beam horizontally
(d) (i) To prevent the ionization of the air molecules due to collision. To prevent the burning up of the hot filament
(ii) The kinetic energy of the fast moving electrons is converted to light and heat energy causing a bright spot on the screen.

146.(a) Alpha particles
Beta radiation
Gamma Radiation
(b) (i) Alpha
(ii) Beta
(iii) Gamma
(c) Alpha deflect to the left and deflects the least .
Beta deflects to the right and deflects the most
Gamma is not affected in the magnetic field.

147.(a) (i) Is the time taken for a radioactive substance to decay to half its original mass.
(ii) This is the unstable isotope that breaks down to form a stable atom.
(iii) These are radiations from environmental sources such as cosmic rays and the radiations from the Earth.
(b) (i) Background radiation
Rocks

(ii) 1. Cosmic rays (from space)
2. Food and drinks
3.Medical (e.g X - rays).
4.Ground and buildings
5.Radon gas from rocks.
(c) **Random** : There is nowhere of telling which atom will decay at a particular time.
Spontaneous: The process occurs naturally and is not affected by external factors such as temperature, pressure, humidity.
Disintegration: Unexpectedly breaking down into small parts.
Parent Nuclide: Unstable nucleus that breaks to form a new stable atom.
Daughter Nuclide : An atom formed when a parent nuclide breaks down.

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148. (a) **METHOD ONE (1)**

(i) $n = \frac{p}{half\ life}$

$n = \frac{10}{2}$

n = 5 half lives

(ii) Fraction remain = $\frac{1}{2^n}$

$\frac{1}{64} = \frac{1}{2^n}$

$2^n = 64$

$2^n = 2^6$

n = 6 half-lives

$n = \frac{p}{half}$

$6 = \frac{P}{2}$

P = 12 years

(iii) $n = \frac{P}{half}$

$n = \frac{4}{2}$

n = 2 half lives

Fraction remain $= \frac{1}{2^n}$ x original

$= \frac{1}{2^2} \times 1000$

= 250g

METHOD TWO(2)

(a) (i) 1000g —— 500g —— 250 —— 125g —— 62.5g —— 31.25g

0 —— 2years —— 4 years —— 6years —— 8 years —— 10 years

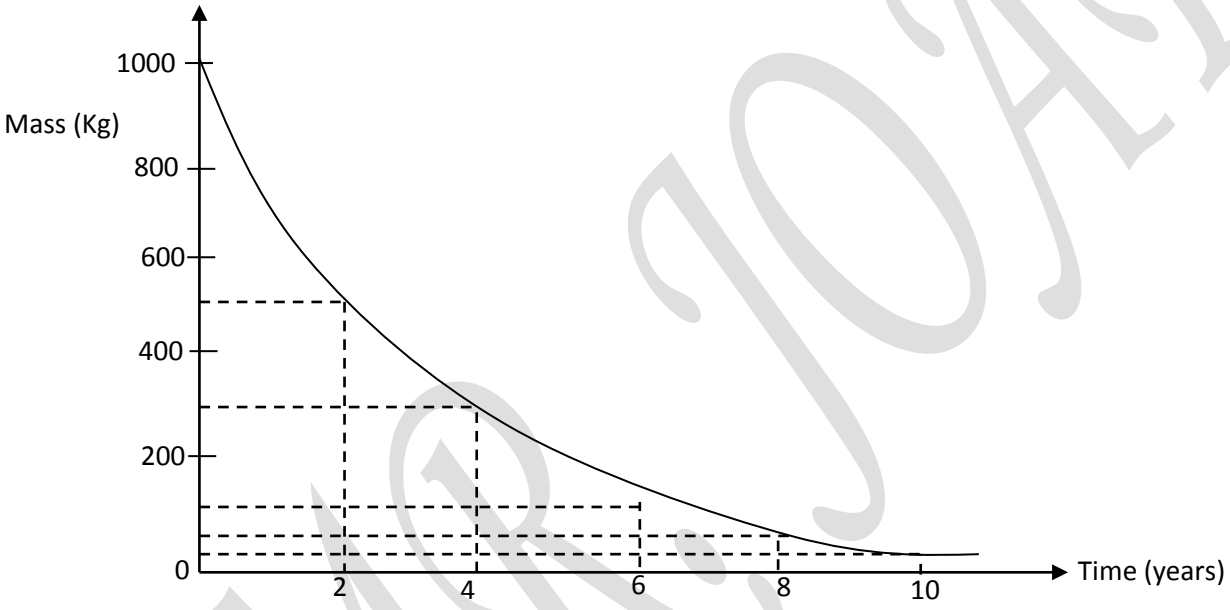
Count the numbers of dashes.

Since the dashes / lines shows the numbers of half lives.

NOTE: When using this method ,mass decreases by half and time doubles.
Time should start from zero

(ii) Use the formula $n = \frac{P}{half\ live}$

(iii) Use the line formula above takes the mass that is corresponding with 4 years.
Actual mass = 250g.



149. (a) Proton
Neutrons

(b) It means that the atom took 6years to decay to half its original mass (1000g) which is 500g.

(c) Neutrons are made up of protons and electrons .When a neutron breaks ,protons and electrons are formed .Protons remain
in the nucleus since they are positively charged and electrons shoots out of the nucleus as fast moving electrons
.Therefore
being emitted as beta particle.

(d) fraction remains = 1 x original mass

$$n = \frac{2^{\frac{P}{half\ live}}}{}$$

$$n = \frac{18}{6}$$

n = 3 half lives

Fraction remains = $\frac{1}{2^n}$

$= \frac{1}{2^3}$

$= \mathbf{\frac{1}{8g}}$

(e) Fraction remains = $\frac{1}{2^n}$

$\frac{1}{16} = \frac{1}{2^n}$

$\frac{2^n}{2^n} = \frac{16}{2^4}$

n = 4half lives

$n = \frac{p}{half\ life}$

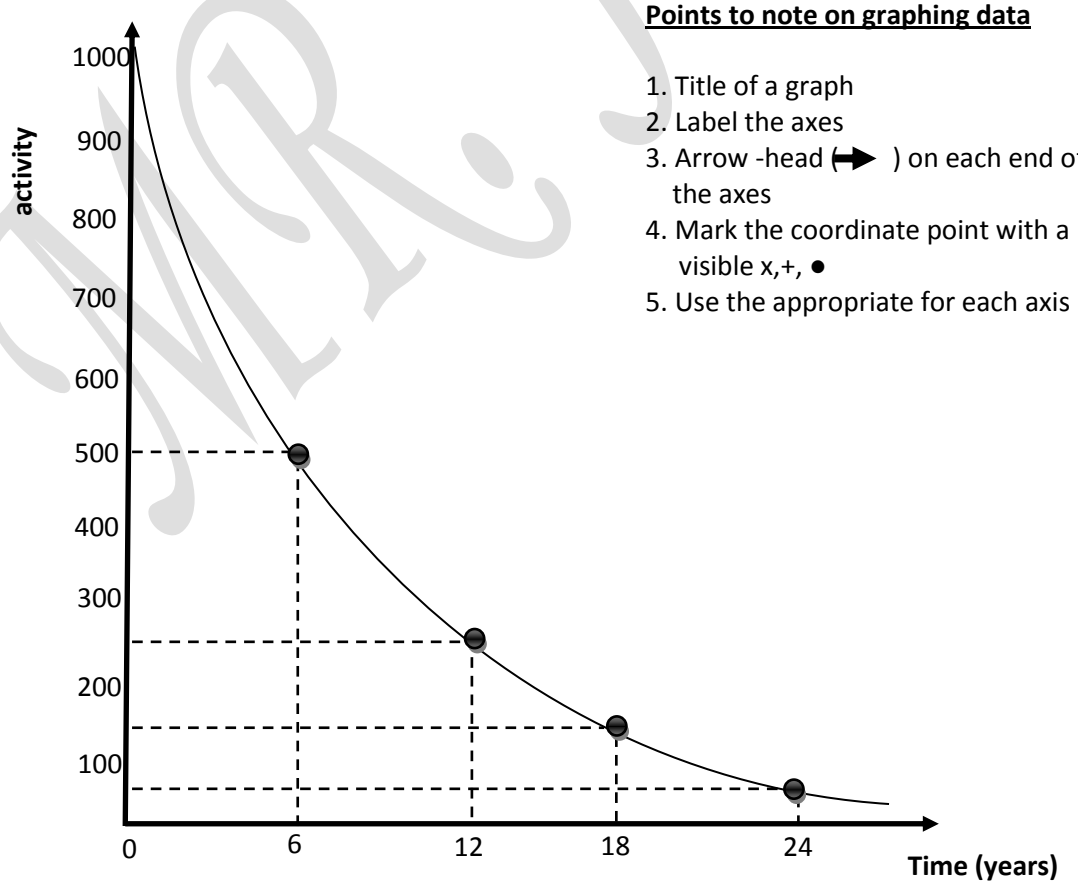
$\frac{6}{1} = \frac{P}{6}$

P = 24 years

NOTE: For the calculations, you can try out second method on part (d) and (e)

TITLE: GRAPH OF ACTIVITY AGAINST

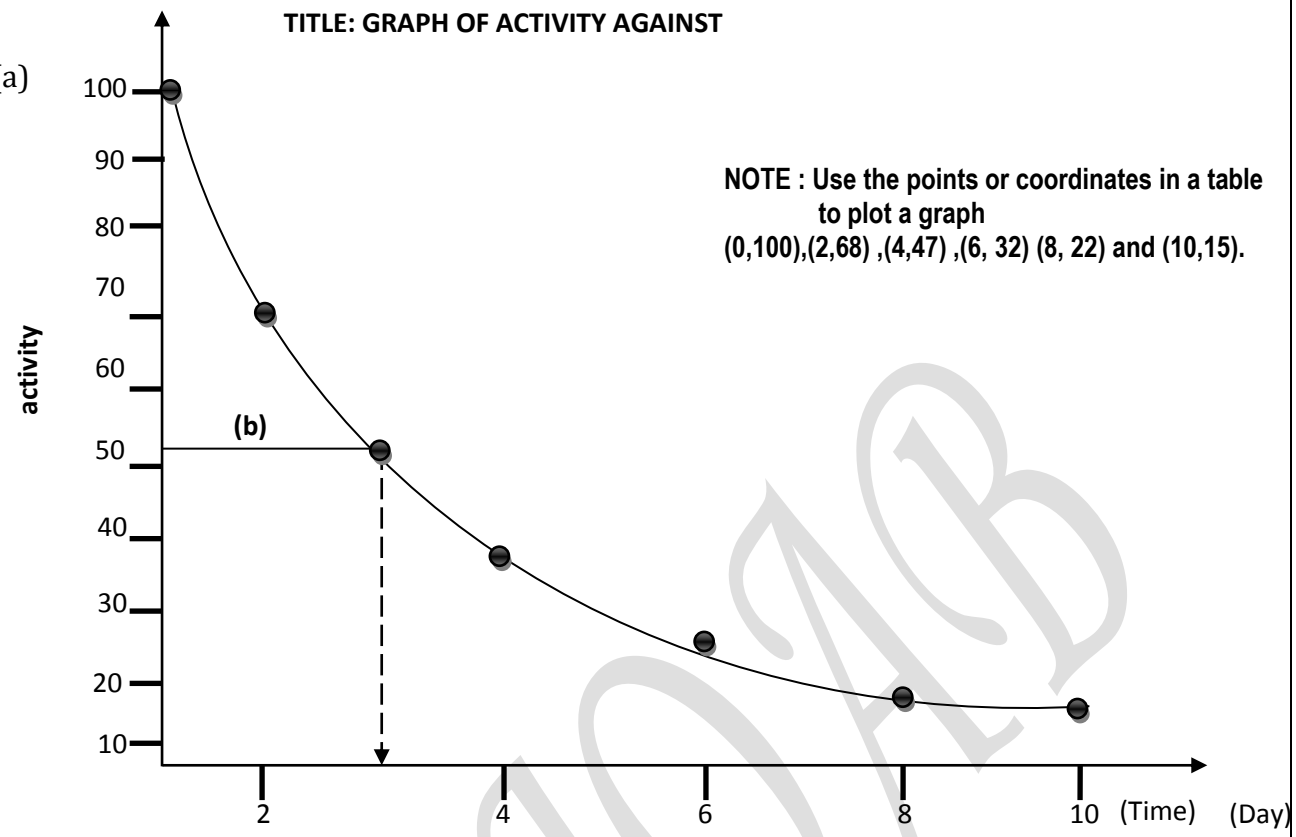
(f)



Points to note on graphing data

1. Title of a graph
2. Label the axes
3. Arrow -head (➡) on each end of the axes
4. Mark the coordinate point with a visible x,+, ●
5. Use the appropriate for each axis

150. (a)



(c) Cosmic rays

Rocks

INDUSTRY USE

Used in detection of cracks in metal castings

AGRICULTURE USE

Used in tracing the liquid flows in plants

MEDICAL USES.

Used in treating cancer by killing the cancer cells

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151. (a) Is the breaking down of the unstable atom to form a stable atom ,resulting in the emission of Alpha, Beta and Gamma particles

(b) (i) Is a helium nucleus.

(ii) Is a fast moving electron

(iii) Is a high energetic electromagnetic wave.

(c) They have different number of neutrons.

152.(a) 1: Photographic film plate:

When the film is developed, the dark patches would be seen.

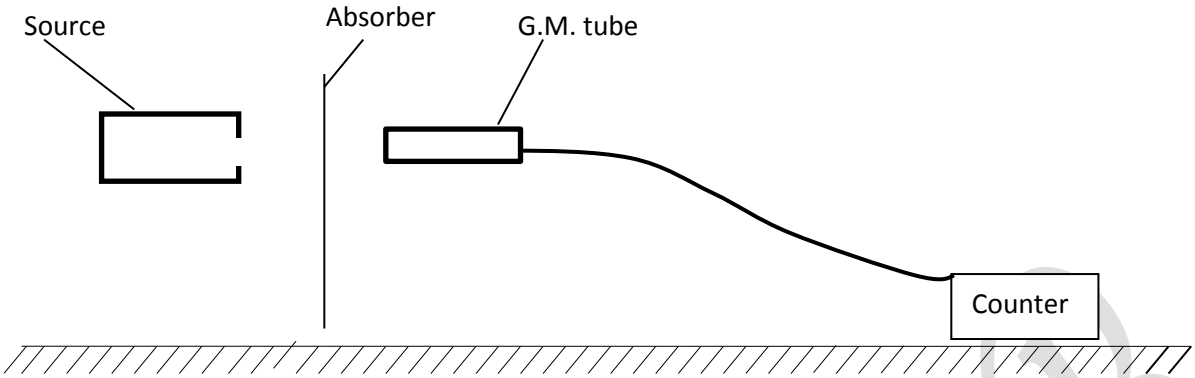
2: Cloud chamber:

If radiation is present, condensation trials would form.

3. Geiger Muller tube (G.M tube)

If radiation is present, the clicking sound would be head.

(b) Set up the apparatus as shown below



Place the source in a lead box with a narrow slit. This is to ensure that only a fine beam of radiation. Then Place a source in front of the counter shown above in the diagram .Place a sheet of paper between the G.M tube and the source, if the count rate falls, then alpha particles are present.

Insert a 3mm thick aluminum sheet behind the paper, if the count rate falls further, then beta particles are present, if this count rate is still larger than the background radiation, then the Gamma rays are present.

WRITE YOUR OWN NOTES.

- ***I PLEDGE TO***
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- ***I PROMISE TO***……
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- ***BIBLE TEXT***……
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- ***PRAYER***……
  ……
  ……***AMEN.***