STUDY WITH TARGET

BIOLOGY
MSCE QUESTIONS WITH SOLUTIONS

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FORCES AND MOTION

1. Give two properties of vector quantities. (2marks)

solution

- The length of the line represents the magnitude of the vector
- The direction of the line shows the direction of the vector.

2. Mention one method of adding vectors acting at an angle to each other. (1mark)

solution

- By scale diagram

3. Mention any two examples of a scalar quantity. (2 marks)

soltution

- Mass,
- Speed,
- Distance,
- Power,
- Time,
- Frequency,
- density

4. Describe how vectors are represented on paper. (2 marks)

solution

- Vectors are represented by arrowed lines. The length of the line indicates the magnitude, and the
  Direction of the arrow indicates the direction of the quantity.

5. Define “resultant vector”. (1mark)

solution

- A resultant vector is a single vector which is equivalent to the combined effect of two or more component vectors acting at the same point

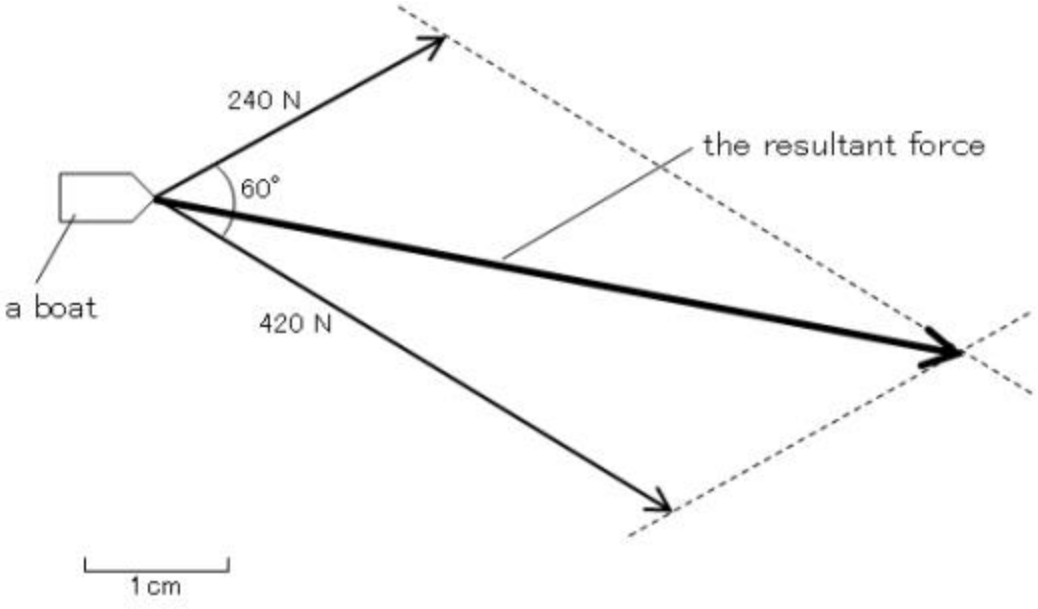
6. Why is “speed” a scalar quantity while “velocity” a vector quantity? (2marks)

solution

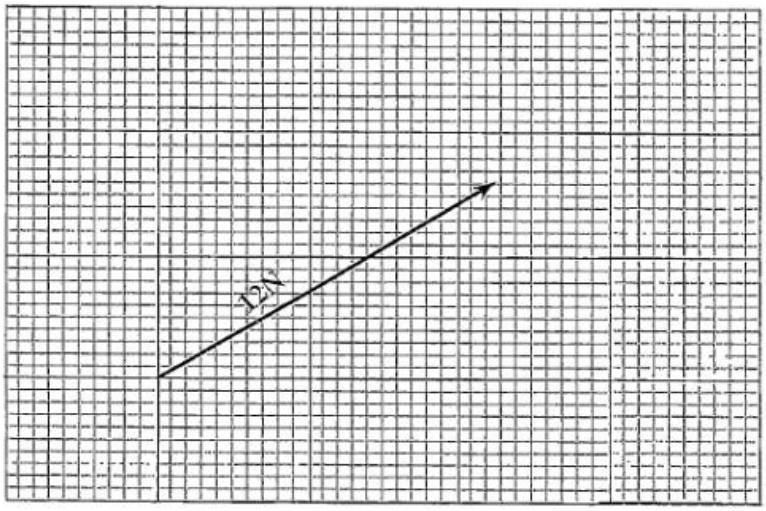
- Because velocity has a size and a direction while speed has only a size.

7. Two forces of magnitude 240 n and 420 n are being used to pull a boat at an angle of 60° to each other. Find the resultant force by using a scale diagram.
(use a scale of 1 cm to represent 100 n) (7marks)

Solution

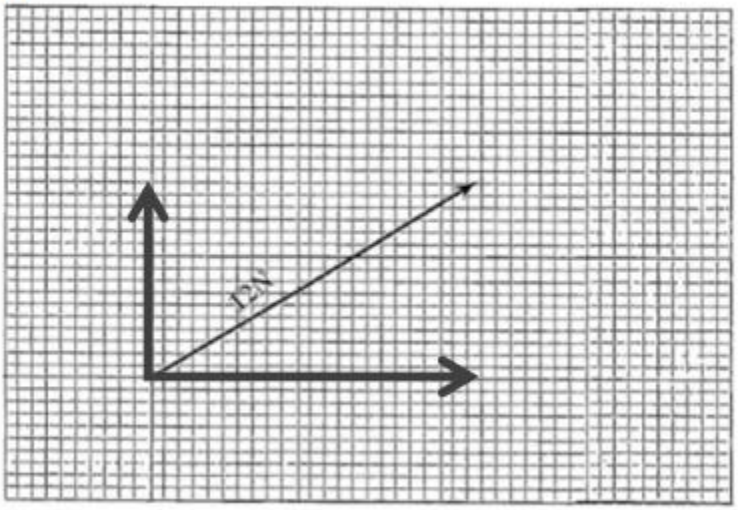


8. **Figure 2** shows a resultant of two forces.



(i) Complete the diagram to show the vertical and horizontal components. (2marks)

solution



➢

(ii) Calculate the magnitude of the horizontal component. (4marks)

➢ **Solution**

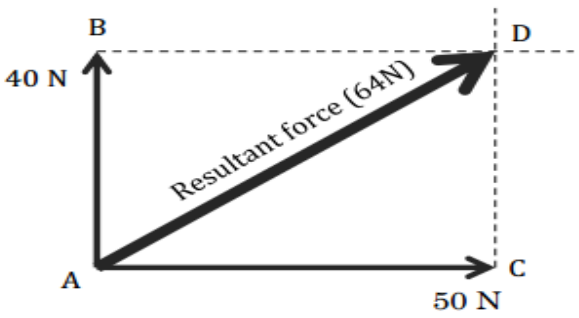
From the resultant force, it shows that 1cm represents 2n.

Horizontal length=5cm

∴ horizontal force = 5 × 2 = 10n

9. Forces of 40n and 50n are acting at right angles. Draw a scale diagram to find the resultant force.(use a scale of 1cm to represent 10n). (5marks)

- **Solution**



AB // CD
AC // BD
ABDC is parallelogram.
$\therefore \overrightarrow{AD}$ is resultant force of two forces of 40N and 50N.

$AD^2 = AB^2 + AC^2$
$= 40^2 + 50^2$
$= 4100$
$\therefore AD \cong 64$

The magnitude of resultant force $\overrightarrow{AD}$ is 64N.

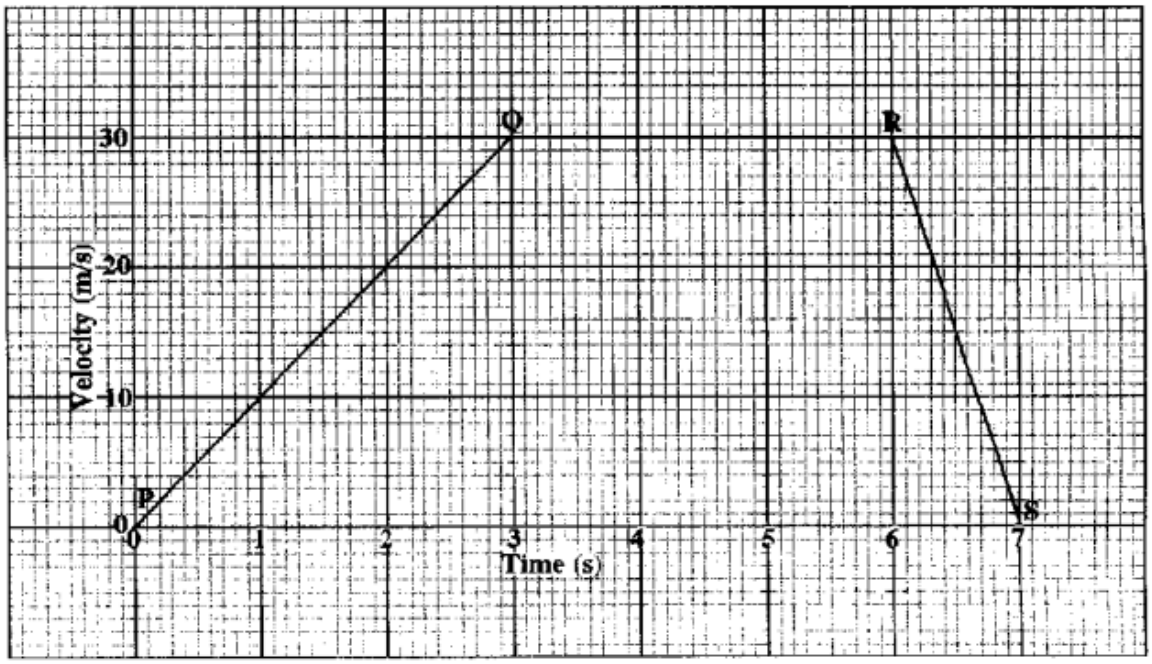
Velocity & acceleration

10. . A car decelerates at a rate of 3m/s2 for 5 seconds. If the initial speed is 20m/s, calculate the final speed. (3 marks)

- **Solution**

The speed of object decreases 3[m/s] per 1second.
Final speed is :
20[m/s]□3[m/s2]□5[s] = 5[m/s]

11. . Figure1 is a velocity-time graph showing a journey made by a cyclist.



Calculate the acceleration from p to q. (3 marks)

➢ **Solution**

.

$$\text{Acceleration} = \frac{\text{final velocity(v)} - \text{initial velocity(u)}}{\text{time taken(t)}} = \frac{(30-0)\,[m/s]}{3\,[s]} = 10\,[m/s^2]$$

12. An object of mass 200 kg accelerates uniformly from rest to a velocity of 20m/s in 4 seconds. Calculate :

(i) Acceleration of the object. (2 marks)

Solution

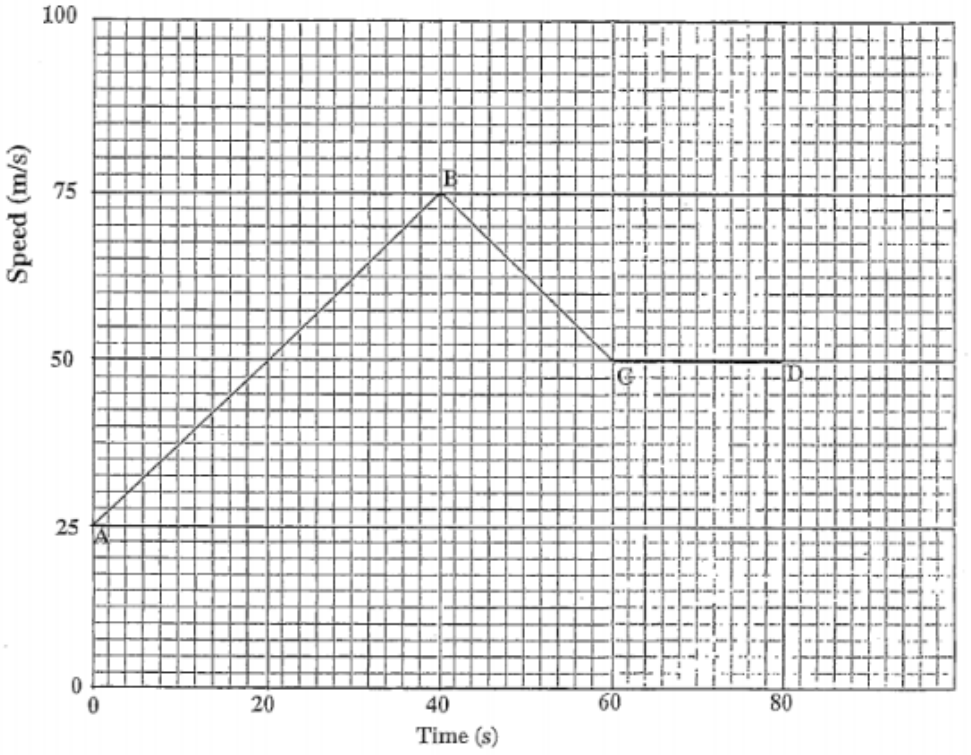
➢ $\frac{20[m/s]}{4[s]} = 5[\mathrm{m}/s^2]$

(ii) Force required to produce the acceleration in 6.d.(i). (2 marks)

Solution

$$F = ma$$
$$= 200[kg] \times 5[m/s^2]$$
$$= 1000\ [N]$$

13. Figure 3 shows a speed-time graph of a car in motion.



(i) Describe the motion of the car from point a to d. (3marks)

➢ **Solution**

From a to b there was uniform acceleration.

From b to c there was uniform deceleration (retardation) of 1.25m/s2.

From c to d there was zero acceleration (constant speed) of 50 m/s

(ii) Calculate the distance covered when the car moves from point a to b. (3marks)

➢ **Solution**

(ii) Distance covered=Area under the graph

$$= \frac{1}{2}(\text{base} \times \text{height}) = \frac{1}{2} \times 40 \times (75 - 25) = \frac{1}{2} \times 40 \times 50 = 1000\text{m}$$

14. Define "acceleration". (1mark)

- Solution

  It is the rate of change of velocity. Or it is the change in speed (velocity) per unit time.

15. The speed of a runner dropped from 80m/s to 60m/s in 4 seconds**.**

(i) Calculate the average deceleration of the runner. (4marks)

- **Solution**

$$a = \frac{v - u}{t} = \frac{60\text{m/s} - 80\text{m/s}}{4\text{s}} = -5\text{m/s}^2$$

$\therefore$ Average deceleration is 5m/s^2

(ii) If the runner maintained the deceleration in .(i) after how long did the speed reach zero?(2marks)

- **Solution**

$$a = \frac{v - u}{t}$$

$$-5\text{m/s}^2 = \frac{0\text{m/s} - 80\text{m/s}}{t}$$

$$t = \frac{-80\text{m/s}}{-5\text{m/s}^2}$$

t=16s

16. Describe an experiment that could be done to determine the average speed of an athlete. (13 Arks)

- **Solution**

  Measure the distance the athlete traveled and the time taken.
  Average speed of the athlete can be calculated as:
  Distance the athlete traveled / the time taken
  (note this is hint you can expand the answer)

17) State two sources of error in 16 (2marks)

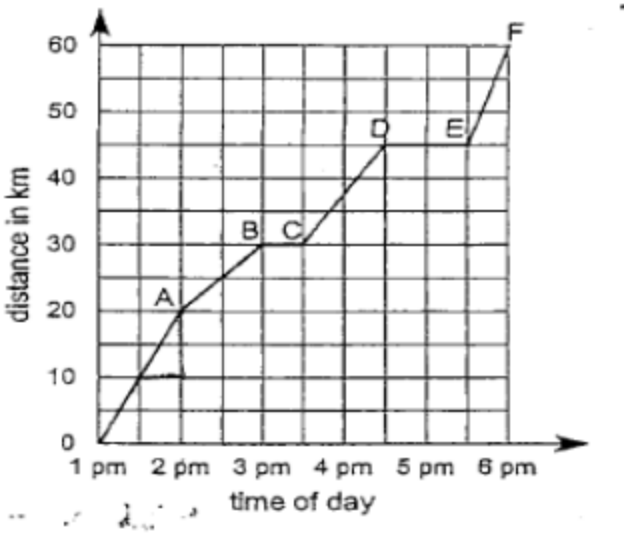
Solution

- Error for measuring distance /
- error for measuring time taken

forces and motion

2003-1.

18) Figure2 is a distance-time graph for a cyclist. Use it to answer the questions that follow.



(i) What is the total distance traveled by the cyclist? (1mark)

- **Solution**

60km

(ii) How long did it take the cyclist to cover the distance? (1mark)

Solution

- 5hours

(iii) Describe the motion of the cyclist from 2:00 pm to 4:30pm (3marks)

Solution

- Velocity from a to b is 10 km/from b to c is 0 km/from c to d is 15 km/h.

(iv) Calculate the average speed of the cyclist during the first 2hours of the journey (3marks)

Solution

$$\text{Average speed} = \frac{\text{total distance}}{\text{time taken}} = \frac{30\ \text{km}}{2\ \text{hours}} = 15\ \text{km/h}$$

(v) It is a scalar quantity because it has no direction.

(v) state whether distance is a vector or scalar quantity. Give a reason for your answer (2marks)

Solution

- It is a scalar quantity because it has no direction.

newton's law

19) State newton's third law of motion. (1mark)

Solution

- For every force of action acting on a body, there is an equal and opposite force of reaction by the body.

20) What is meant by "free fall" of an object? (2 marks)

solution

- Free fall occurs when an object falls with uniform acceleration under the force of gravity if air resistance is negligible.

21) Figure 7 is a diagram showing a person rowing a boat on a lake.

(i) Explain how rowing causes the boat to move. (3 marks)

solution

- By rowing, the person exerts force on water backwards. Then the force from water reacts on the oar forward, which accelerates the boat

(ii) Which newton's law of motion is demonstrated in the diagram? (1 marks)

solution

- Newton's third law

(iii) Mention any two forces acting on the boat. (2 marks

solution

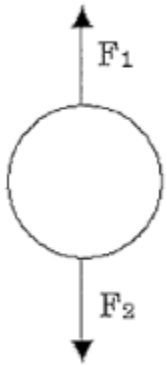
- Resistance due to water;
- Reaction of water through the oar

22) A. State any two factors that affect the terminal velocity of a free falling object in air. (2 Marks)

solution

- Air resistance (friction force) and
- force of gravity
- Weight of the object

23) figure 6 is a diagram showing an object falling at terminal velocity. F1 and f2 are forces acting on the object.



(i) Name the forces f1 and f2. (1 mark each)

solution

- **F1:** air resistance
- **f2:**weight or gravitational force

(ii) What would be the relationship between the magnitude of f1 and f2 at terminal velocity? (1 mark)

solution

- **F1** is the same as **f2.**

24) . State newton's second law of motion. (1 mark)

solution

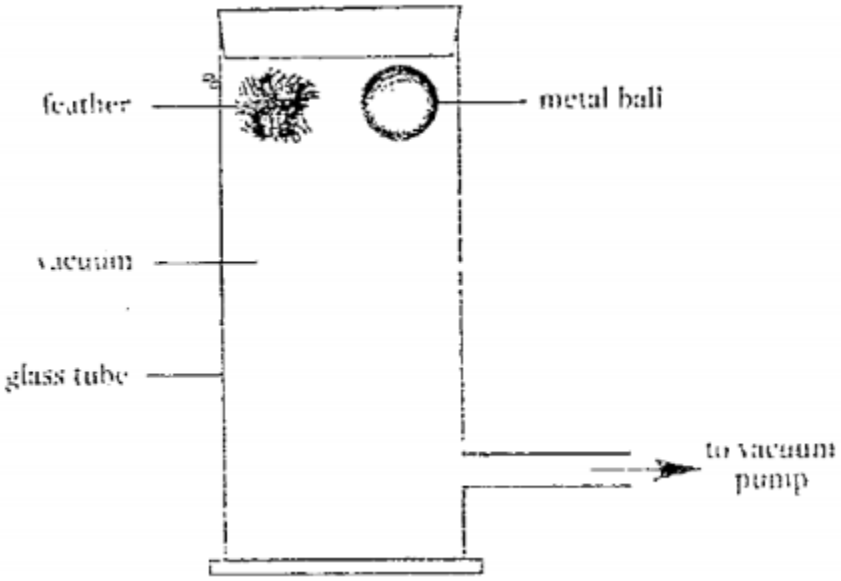
- it states that the rate of change of momentum of an object is directly proportional to the force acting on the object.

25) a metal ball is released on the surface of lubricating oil in a tall glass tube. Explain the change in velocity of the ball as it falls through the oil to the bottom of the tube. (8marks)

solution

- At the start the weight (w) of the ball makes it fall vertically downwards under gravity and is greater than the upward viscous force opposing its motion. As the ball speeds up, the upward force (fluid friction) increases and eventually equals weight w of the ball. The forces acting on the ball then balance and it moves with constant speed (terminal speed); the ball reaches the bottom of the tube with this constant speed,

26) figure 3 is a diagram of a set up used in an experiment that was carried out to investigate how a feather and metal ball would fall in a vacuum.



(i) Name the resultant force acting on the ball. (1mark)

solution

- Gravitational force

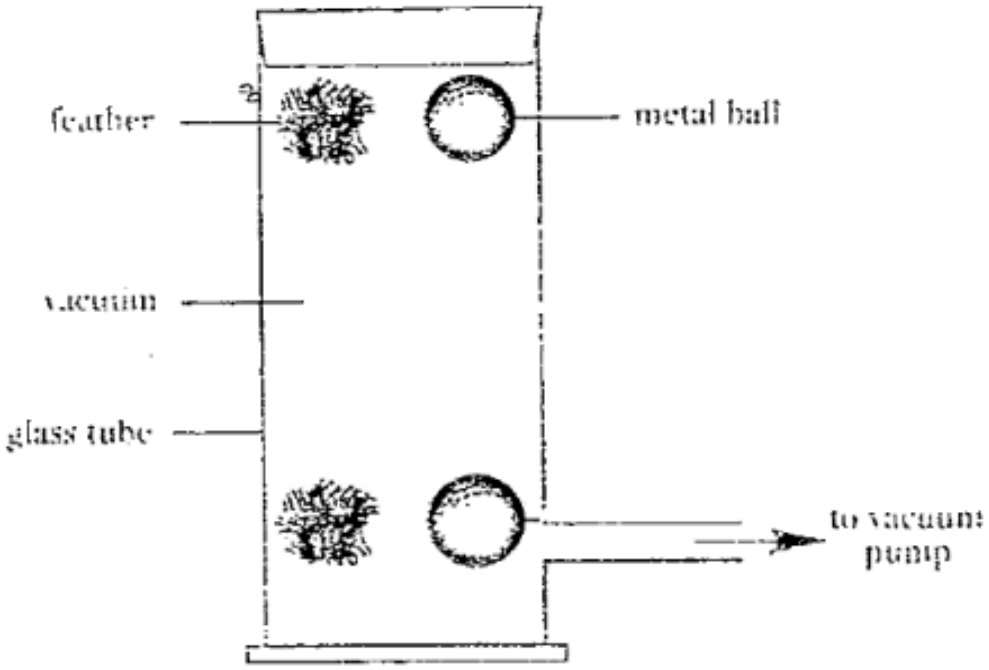
(ii) State the direction of the resultant force in (i) . (2marks)

Solution

- Downwards

(iii) If the feather and the metal ball where allowed to fall at the same time. Draw in the diagram to show the positions of both the feather and metal ball before they reach the bottom of the tube.

Solution



➢

(iv) Explain your answer to 26(iii) above. (2marks)

Solution

➢ Because the falling motion does not depend on mass of the object in case of the condition which has no air resistance in vacuum condition.

ELECTRICITY

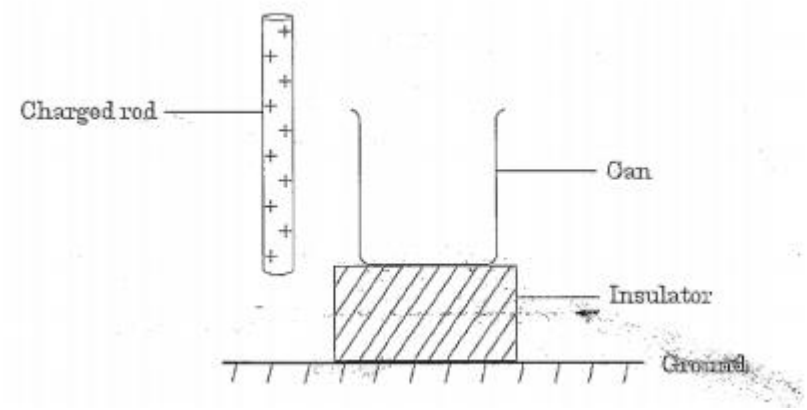
27) mention any two appliances that use the principle of electrostatics. (2 marks)

Solution

➢ Photocopying machines

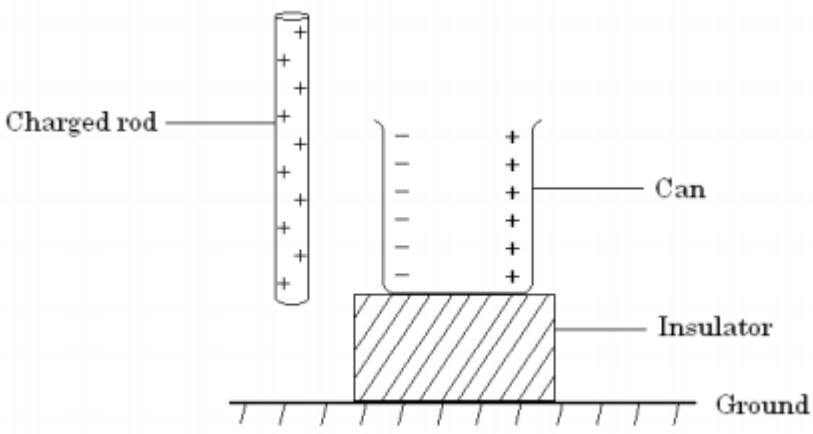
➢ capacitors

28) E. Figure 4 is a diagram showing a charged rod brought close to metal can standing on aninsulator.



(i) Complete the diagram by indicating the induced charges on the can. (2 marks)

➢ **Solution**



29) (ii) why was the can on an insulator?

solution

➢ because without an insulator, the charge flows away to ground.

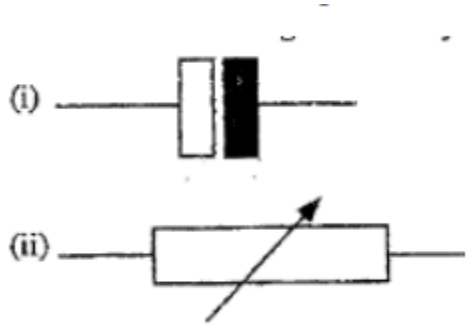
30) explain the difference in total resistance between similar resistors connected in series and parallel.(4 marks)

Solution

➢ When resistors are in series, the combined resistance is the sum of the individual resistance and is greater than any individual resistance. In case of connecting

resistors in parallel, the combined resistance is the sum of the reciprocal of all resistances, and is thus less than the resistance of the smallest individual resistor.

31) what do the following electrical symbols stand for? (1mark)



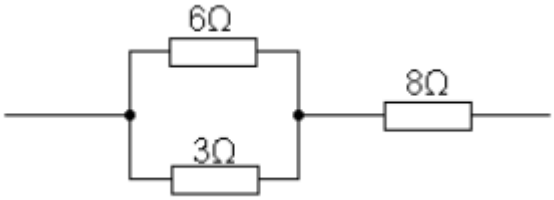
Solution

- (i) electrolytic capacitor
- (ii) rheostat (or variable resistor)

32) in a circuit, a 6Ω resistor and a 3 Ω resistor are connected in parallel and an 8 Ω resistor is connected in series with them.

(i) Draw a circuit diagram using the given information. (2marks)

Solution



(ii) Calculate the total resistance in the circuit. (5marks)

Solution

) combined resistance in parallel:

$$\frac{1}{R}=\frac{1}{6}+\frac{1}{3}=\frac{1+2}{6}=\frac{3}{6}=\frac{1}{2}$$

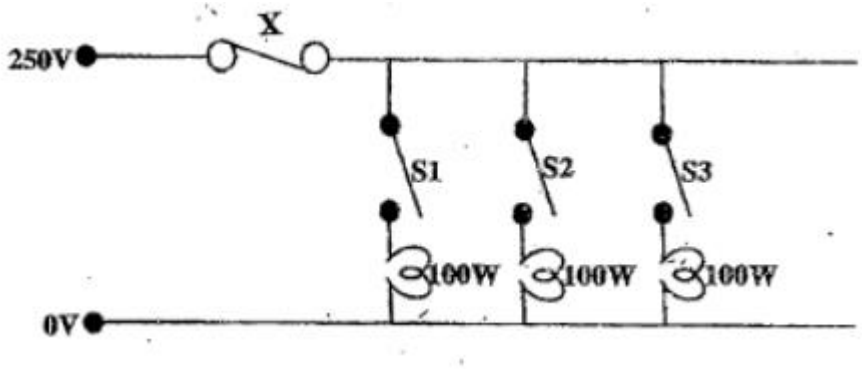
$$\therefore R=2\Omega$$

combined resistance in total:

$$R=2+8=10\Omega$$

➢

33) Figure 5 is a diagram of an electric circuit for a house.



(i) What type of circuit is shown in the diagram? (1mark)

Solution

➢ Parallel circuit

(ii) Give two reasons why this type of circuit is preferred for wiring houses. (2marks)

Solution

➢ - voltage across each component can be equal.

➢ - each component is controlled by its own switch.

(iii) Explain the importance of including the device labeled x in the circuit in figure 5. (3marks)

Solution

- Device x is a fuse. The fuse can avoid that overload current. If a fault occurs and too much current flows, the fuse wire melts before anything else is damaged or starts a fire.

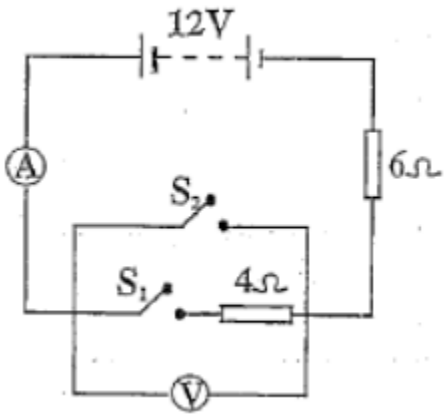
(iv) give any one appliance where device x is used. (1mark)

solution

***choose one answer from below.**

- - cooker,
- Kettle,
- iron,
- Oven

34) figure 2 is a diagram of an electric circuit.



(i) if s1 is closed and s2 is open, calculate the reading of the ammeter and voltmeter.

Ammeter: (3marks)

Solution

Ammeter; $V = 12V, R = 6\Omega + 4\Omega = 10\Omega$

$$I = \frac{V}{R} = \frac{12V}{10\Omega} = 1.2A$$

➢ $\therefore$ Ammeter reading is 1.2A

Voltmeter. (3marks)

Solution

Voltermeter: $I = 1.2A, R = 4\Omega$

$V = IR = 1.2A \times 4\Omega = 4.8V$

$\therefore$ Voltmeter reading is 4.8V

(ii) What will be the effect on the voltmeter if both switches are closed? (1mark)

Solution

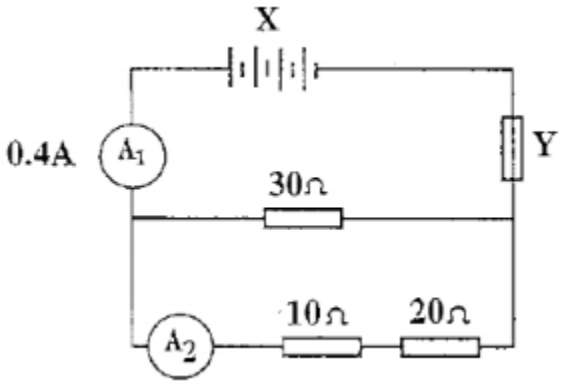
➢ The voltmeter will read the same, i.e. 4.8v.

(iii) give a reason for the answer to .(ii) (1mark)

solution

➢ This is because the voltage in parallel circuit (components) is the same

35) Figure 3 is a circuit diagram.



(i) Name the components labeled x and y. (1mark each)

Solution

- **x:** battery
- **Y:** fuse

(ii) Calculate the total resistance in the circuit. (5marks)

Solution

In series:

$$R = 10\Omega + 20\Omega = 30\Omega$$

In parallel:

$$R = \frac{R_1 R_2}{R_1 + R_2} = \frac{30 \times 30}{30 + 30} = \frac{900}{60} = 15\Omega$$

- ∴ Total resistance in the circuit is 15Ω

(iii) Calculate the current in the 30Ω resistor. (2marks)

Solution

- V = ir = 0.4a × 15ω = 6v

∴ current in the 30ω resistor

$$I = \frac{V}{R} = \frac{6V}{30\Omega} = 0.2A$$

(iv) Work out the voltage across the 10 Ω resistor. (2marks)

Solution

- **V =** ri = 0.2a × 10ω = 2v

36) describe an experiment that could be done to find out if electrical resistance of a wire Varies directly proportional to its length (11marks

Solution

- Prepare 2 different length of nicrome wire. Let electricity flow and measure voltage and current of those two wires by using voltmeter and ammeter. Calculate the resistances by using formula of resistance = voltage / current. Draw

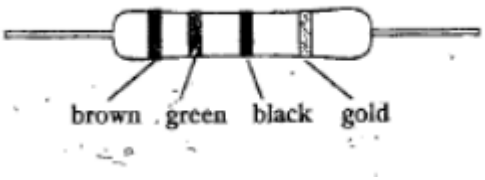
a graph for the length of wire against its resistance.it should show directly proportional.
(***expand your answer by using knowledge you have acquired from your teacher)***

37) explain why a voltmeter is connected in parallel while an ammeter is connected in series. (4marks)

Solution

- Because voltmeter is for measuring a pressure of electricity flow which needs to measure two different points. Whereas ammeter is measuring an amount of electricity flow which needs to measure only one point. Therefore voltmeter is connected in parallel while ammeter is connected in series.

38) B. Figure 2 is a diagram of a resistor.



39) What is the resistance of the resistor? (3 marks

Solution

- $15\Omega \pm 5\%$

(i) Are the head lamps of a motor car connected in series or in parallel? (1 mark)

Solution

- Parallel

(ii) Give a reason for the answer to 4.e(i). (1 mark)

Solution

- Same voltage with a buttery can provide to two or more headlamps.

Power and cost of electricity

40) Figure 2 is a diagram of an electric circuit

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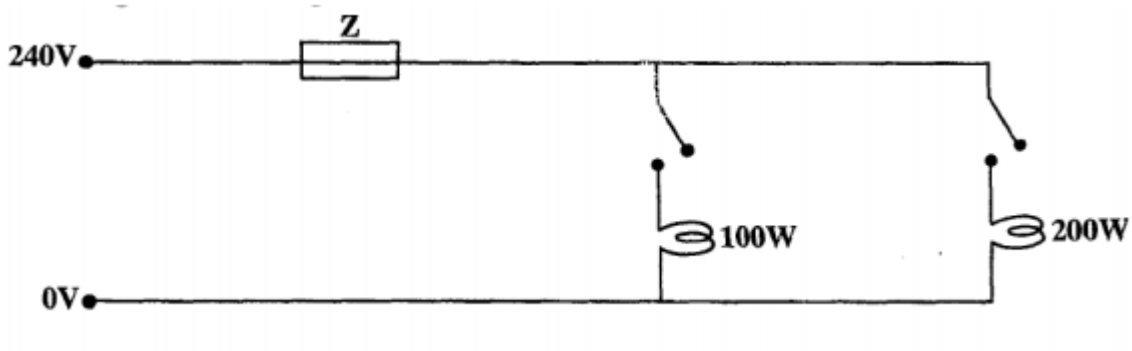


(i) What is the function of the part labelled z? (2marks)

Solution

- It prevents the high current flows in electrical circuit

(ii) State any two advantages of the circuit in figure 2. (2marks)

Solution

- Same voltage can be applied both bulbs

(iii) Which bulb would use more current if both switches were closed? (1mark)

Solution

- 200w bulb

(iv) Give a reason for the answer in (iii). (1marks)

Solution

- Because 200w bulb consumes larger electrical energy than 100w bulb when same voltage are applied.

41) . Calculate the power dissipated in an electric heater in which 4a of current flows when connected to a 230v supply. (3marks)

Solution

- Electrical power = voltage x current.
  So, electrical power = 230v x 2a = 460w

42) Define "electrical power". (1 mark)

Solution

- Electric power is the rate of energy consumption in an electrical circuit.

43) an electric bulb is marked 240v, 60w.

(i) What is the meaning of "240v, 60w"? (2 marks)

Solution

- 240v" indicates voltage for use and "60w" indicates electrical**"** energy

(ii) Calculate the heat dissipated by the bulb, in joules, if it operates for 8 minutes. (3 marks)

Solution

8 minutes = 480 seconds.

Electrical energy [J] = Electrical power [W] × time[s]

= 60[W] × 480[s]

= 28,800 [J]

-

44) A current of 2a flows through an electric heater connected to a voltage supply of 240v. Calculate

(i) Resistance of the element, (2marks)

Solution

- **I**=2a, v=240v,

$$R = \frac{V}{I} = \frac{240V}{2A} = 120\Omega$$

(ii) Power displaced by the heater, (2marks)

Solution

$$P = IV = 2A \times 240V = 480W$$

- I

(iii) Cost of running the heater for 3 hours if the cost of electrical energy is k5 per kwh. (4marks)

Solution

➢

$$\text{Electrical energy} = P \times t = \frac{480}{1000}\text{kW} \times 3\text{h} = 1.44\text{kWh}$$

$$\text{Cost of electrical energy} = \text{k}5.00 \times 1.44 = \text{K}7.20$$

45) (i) define "kilowatt hour" (2marks)

Solution

➢ It is the electrical energy used by a 1 kw appliance in 1 hour.

(ii) The power rating of a television is 150w. How much power in kilowatt hours will it use if it is on for 109 hours? (3marks)

Solution

➢

$$P = 150\text{W} = \frac{150}{1000}\text{kW} = 0.15\text{kW}$$

$t = 10$ hrs

$$\therefore \text{Electrical energy} = 0.15\text{kW} \times 20\text{hrs} = 3\text{kWh}$$

(iii) If the cost of power is k5.00 per kilowatt hour, that will be the cost of running the television in.(ii) for 10 hours per day for 2 days. (4marks)

Solution

➢

$$P = 150W = \frac{150}{1000}kW = 0.15kW$$

t=10 hrs

∴ Electrical energy = 0.15kW × 20hrs = 3kWh

∴ Cost = K5.00 × 3 = K15.00

46) 6kw of power is fed to a transmission cable of resistance 3 ohms. Calculate the power wasted in the cable if power is transmitted at 300v. (4marks)

- **Solution**

  P = 6 kW = 6000W, R = 3Ω, V = 300V.

  Electrical current passing through the cable is:

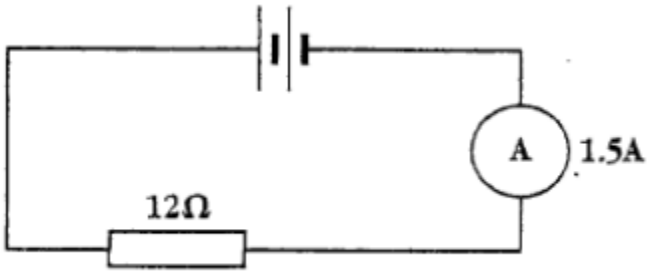
  I = P/V = 6000W/300V = 20 A

  Power wasted in the cable is:

  $P = I^2R = 20^2 \times 3 = 1200W$

-

47) figure 1 is a diagram of an electric circuit.



(i) What kind of energy is produced in the 12Ω resist or as electric current flows though it? (1mark)

Solution

- Heat energy

(ii) Calculate the amount of energy produced in the resistor if electric current flows . (3marks)

solution

$V=IR, \quad V = 12\times1.5 = 18V$

Electrical power P is:

$P=VI, \quad P = 18\times1.5 = 27W$

➢

MAGNETISM AND ELECTROMAGNETIC INDUCTION

48) Explain how a piece of steel could be magnetized by single touch stroking method. (2marks)

- **Solution**
- The domains inside of steel are rearranged toward same direction of stroking. Therefore it can be magnetized.

49) give any one method of demagnetizing a permanent magnet. (1 mark)

- **Solution**
- Heating it strongly (red hot) /
- leaving a magnet in the solenoid while the current is reduced to zero.

50) briefly explain how a piece of iron can be magnetized by stroking. (5marks)

- **Solution**
- The domains inside of steel are rearranged toward same direction of stroking. Therefore it can be magnetized**.**

51) State two ways of inducing electromotive force(emf). (2marks)

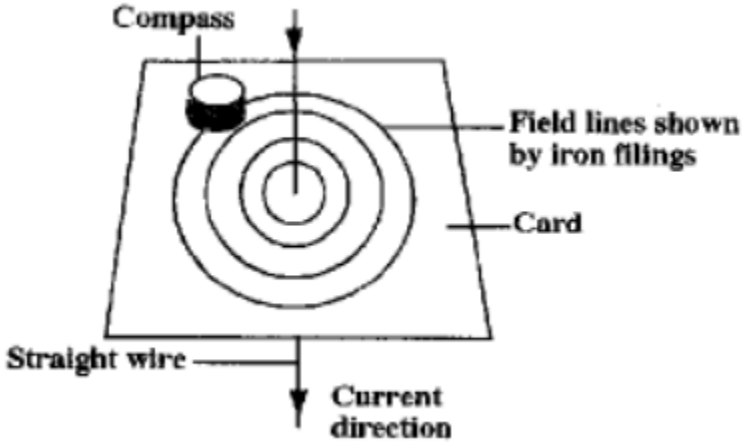
- **Solution**
- Using electromagnetic induction/ using a cell connecting complete circuit

52) Mention any one application of an electromagnet. (1mark)

Solution

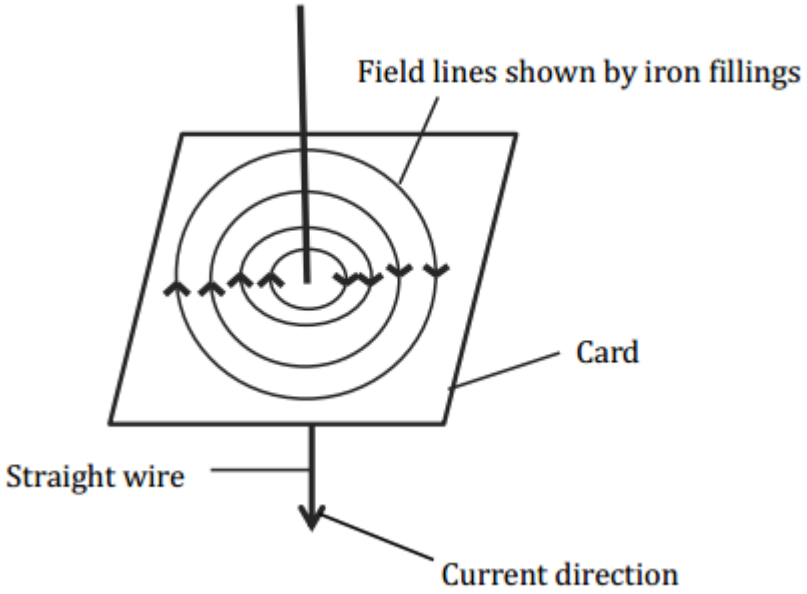
- Electric motor /
- dynamo /
- ammeter

53) figure 2 is a diagram showing an experiment on electromagnetism in which a current carrying wire passed through the centre of a card on which iron fillings were sprinkled.



(i) Draw an arrow in the compass to show the direction of field lines. (1 mark)

➢ **Solution**



➢

(ii) What would happen to the direction of the compass needle if the direction of current was reversed? (1 mark)

➢ **Solution**

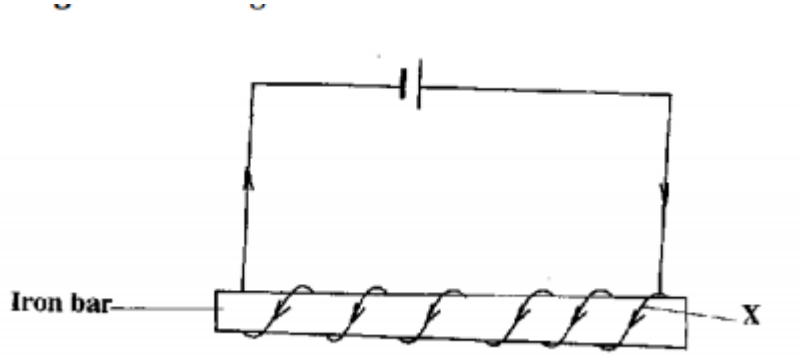
➢ The compass needle points in the opposite direction.

(iii) Give a reason for the answer in 53.(ii). (1 mark)

➢ **Solution**

➢ When the direction of current reverses, the direction of the field reverses too. Therefore the compass needle also reverses.

54) figure 4 is a diagram of an electric circuit.



(i) Name the part labelled x. (1 mark)

- **Solution**
- Solenoid

(ii) What would happen if the part labelled x is brought close to iron fillings? (1 mark)

- **Solution**
- Iron fillings would be attracted to the iron bar.

(iii) Give a reason for the answer in 54.(ii). (2 marks)

Solution

- The iron bar gets magnetised due to the electric current

(iv) What is the role of the iron bar in the circuit? (1 mark)

Solution

- It increases the strength of the magnetic field.

55) a step down transformer has 1200 turns in the primary coil and 50 turns in the secondary coil.calculate the voltage in the secondary coil if the voltage in the primary coil is 240v. (3 marks)

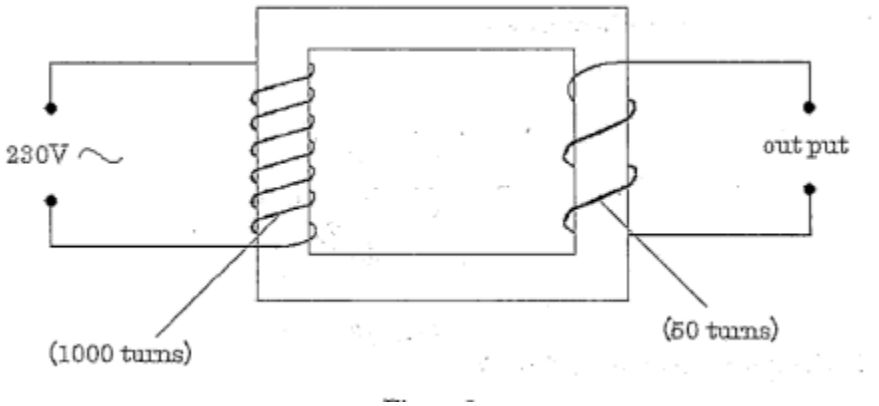
- **Solution**

$$\frac{240[V]}{1200} = \frac{V}{50}$$

$$\therefore V = 10V$$

-

56) figure 2 is a diagram of a transformer.



57) (i) name the type of transformer shown in the diagram. (1 mark)

- **Solution**
- Step-down transformer

(iii) Give a reason for the answer to 4.a.(i). (1 mark)

Solution

- It is because the number of turn in the output coil is less than the number of turns in the input coil.

(iii) calculate the output voltage of the transformer. (3 marks)

solution

$$\frac{N_1}{N_2} = \frac{V_1}{V_2}$$

$$V_2 = \frac{V_1 \times N_2}{N_1} = \frac{230 \times 50}{1000} = 11.5$$

11.5 V

❖

58) (i) give one advantage of alternating current over direct current. (1mark)

- **Solution**
- It can be transmitted over long distances. It can be easily stepped up or down. Line losses are minimized for a given wattage delivery and wire diameter

(iv) State any two causes of energy loss in a transformer. (2marks)

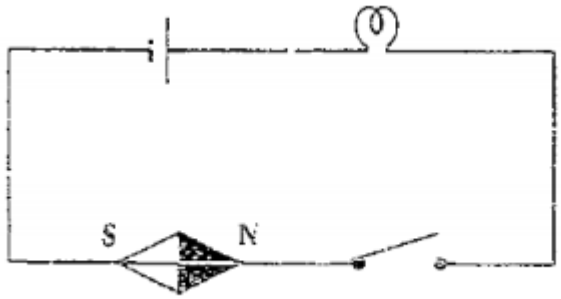
- **Solution**
- Heat energy lost due to resistance in the wire windings
- Eddy's currents
- Flux leakage

(v) How can each cause of energy loss mentioned in 4.b.(ii) be reduced? (2marks)

solution

- Resistance in the windings can be reduced by using thicker copper wires which have low resistance. Coolants can also be used to cool down the transformer.
- Eddy's currents can be reduced by using laminated iron core, i.e. Iron is layered to increase resistance.
- Flux leakage can be reduced by good designing of the transformer. This is achieved by winding primary on top of the secondary and having a 'closed' iron core.

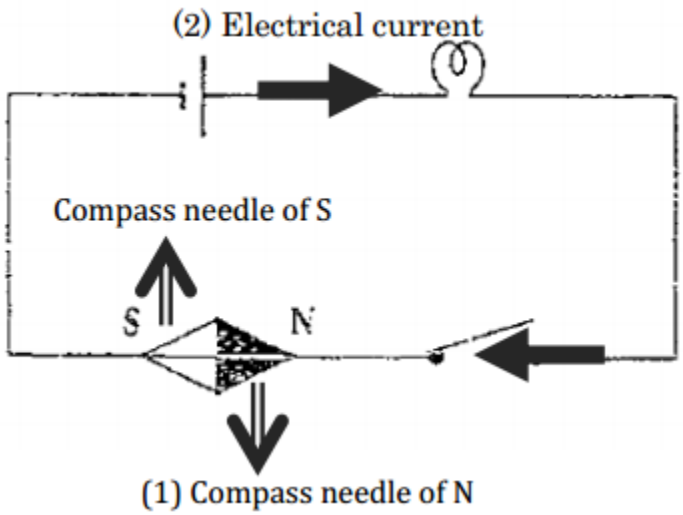
59) D. Figure 2 is a diagram of a compass needle placed under a connecting wire.



(i) draw arrows on the diagram to show, when the switch is closed. The direction of movement of:

(1) the compass needle.

- **Solution**



-

(2) the current (2marks)

- **Solution**
-

(ii) what effect would the following changes have on the movement of the compass needle?

(1) Reversing the cell. (1mark)

Solution

- The direction of compass needle will be reversed.

(2) Increasing the number of cells. (2marks)

Solution

- There is no movement.

60) Mention two devices which use electromagnets. (2marks)

Solution

- Speaker /
- electrical bell

(i) Explain the difference between an electric motor and an electric generator. (2 marks)

Solution

- Electric motor is a device to create a rotating movement using electricity. Whereas an electric generator is a device to create electricity using a rotation movement.

(ii) state any two factors which affect the amount voltage produced by a generator. (2 marks) **solution**

- Strength of magnet /
- Number of turn of coil

61) (i) describe how a step up transformer works. (6marks)

Solution

- A step up transformer has a more number of turns on the secondary coil than that of primary coil. When current is applied to the primary coil, it produces magnetic field magnetic field which is cut by the secondary coil. Then the secondary coil induces secondary current and voltage. The ratio of number of turns on primary and secondary coil is equal to the ratio of primary voltage and secondary voltage, respectively

(ii) Explain two ways in which energy losses in a transformer are minimized. (4marks)

Solution

- Using oil in a transformer to cool it down.
- Using thick irons covers to have high resistance.

Electricity, magnetismand electromagnetic induction ii

62) give two types of semiconductors. (2 marks)

Solution

- P-type and
- n-type semiconductors**.**

63) A. In terms of the band theory, explain why resistance of a semiconductor decreases when temperature increases. (4 marks)

Solution

- A semiconductor conducts better when some heat energy is supplied to it (or its temperature is increased) because in so doing the electrons are promoted (excited) from the valence band to the conduction band. This decreases the resistance of a semiconductor, and electrons easily flow in the material

64) with the aid of labeled diagrams, explain the difference between waves passing through narrow and wide gaps. (6 marks)

Solution

-

65) (i) what are "semiconductors"? (1 mark)

Solution

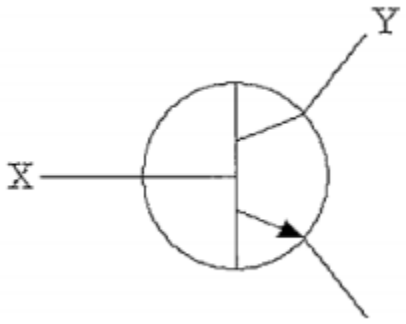
- Semiconductors are solids which conduct electricity better than insulators but not as well as conductors.

(iii) Explain how raising the temperature of semiconductors affects their electrical conductivity. (2 marks)

Solution

- As the temperature rises, the electrical conductivity increases.

66) figure 3 is a diagram of a transistor.



(i) Name the parts marked x and y. (1 mark each)

Solution

- **X:** base
- **Y:** collector

(ii) give any two uses of transistors. (2 marks)

Solution

- Switching /
- Amplifying of an electric current

67) (i) why are "diodes" sometimes referred to as "rectifiers"? (2 marks)

Solution

- Diodes can remove all the current flowing in one direction from alternating current.

(ii) Draw a circuit diagram consisting of a cell, a bulb and a diode such that the diode is forward biased. (8 marks)

Solution

-

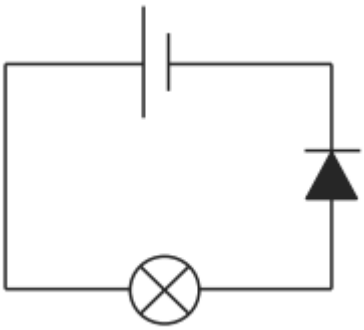
68) (i) what is a "semiconductor"? (1 mark)

solution

- It is a materials that allow current to pass through under certain conditions.

69) (ii) draw a circuit diagram in which a bulb, a cell and a diode are connected in series such that the diode is forward biased. (2 marks)

Solution



(iii) What is meant by the term "doping" in relation to a semi-conductor? (2 marks)

Solution

- is the method of applying impurities to improves conductivity of a semiconductor**.**

(iv) State two functions of transistors. (2 marks)

Solution

- Transistors can amplify current, can control current as an electronic switch

oscillations and waves

70) A. Define "oscillation".

Solution

- Oscillation is regular movement between one position and another position.

71) (i) state any two factors which affect frequency of an oscillating pendulum. (2 marks)

Solution

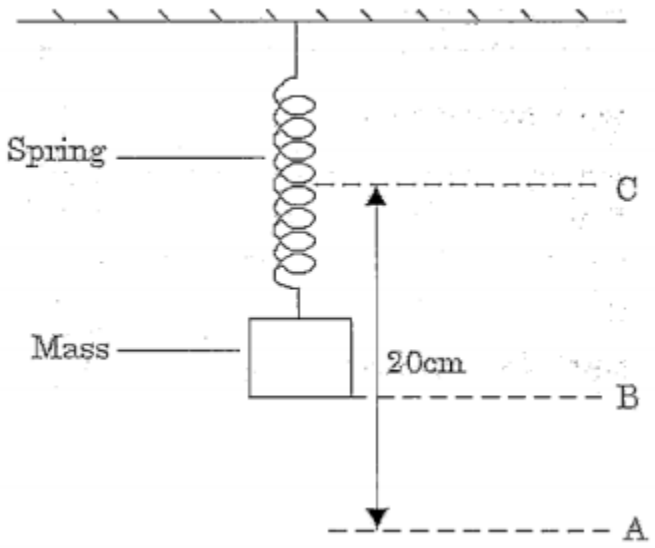
- The length of the string;
- Acceleration due to gravity

(iii) Mention two characteristics of an oscillating system. (2 marks)

Solution

- The vibrating material moves to and fro about a fixed position;
- the sum of its kinetic, potential and strain energy is constant.

72) figure 1 is a diagram showing a mass hanging on a spring. If the mass is pulled to point a and released, it vibrates between points a and c through the rest position, b.



(i) Calculate the initial amplitude of the vibration. (2 marks)

Solution

- 20cm ÷ 2 = 10cm

(ii) At which point does the vibrating mass have the highest kinetic energy? (1 mark)

Solution

- **B**

(iii) Describe how potential energy and kinetic energy change as the mass is vibrating from a to c.(4 marks)

Solution

- At point a, the mass has potential energy only. From point a to b, potential energy decreases and kinetic energy increases. At point b, the mass has kinetic energy only. From point b to c, kinetic energy decreases and potential energy increases. At point c, the mass has potential energy only.

(iv) give two reasons why the mass would eventually stop vibrating. (2 marks)

Solution

- ***choose two answers from below.
- A part of kinetic energy changes to heat energy.
- A part of kinetic energy changes to sound energy.

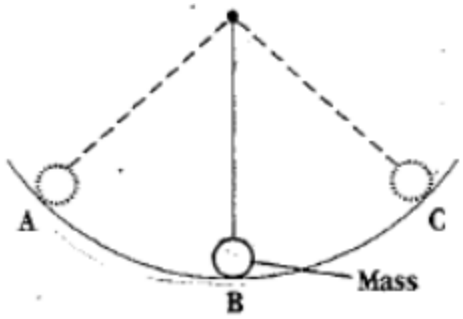
- All energy is changed to heat as a result of overcoming air resistance

73) define the term "oscillation" in relation to a swinging pendulum. (2 marks)

Solution

- Oscillation is regular movement of a swinging pendulum from one side to another side.

74) Figure 3 is a diagram of a simple pendulum. The mass vibrates between points a and c through b.



(i) what happens to the speed of the mass as it moves from positions:

(1) a to b? (1 mark)

Solution

- **(**increases

(2)

B to c? (1 mark)

- Decreases

(iii) What is the speed of the mass at c? (1 mark)

Solution

- Speed at c is zero.

(iv) What happens to the frequency and amplitude of oscillation of a pendulum as time increases? (2 marks)

Solution

- Frequency do not change. Amplitude decreases

(v) State the energy changes of the mass as it changes from a to c. (2 marks)

Solution

- The energy changes from potential energy to kinetic energy as the mass moves from a to b.the energy changes from kinetic energy to potential energy as the mass moves from b to c.

(vi) What happens to the frequency of vibration of a pendulum when the length of the string is changed? (2 marks)

Solution

- As the length of the string decreases, frequency increases.

75) (i) what type of wave is produced by a vibrating string? (1mark)

Solution

- Transverse wave

(iii) Calculate the frequency of a wave with a wavelength of 2m and speed of 6m/s. (3marks)

Solution

- frequency = speed ÷ wavelength
- So, frequency = $6m/s \div 2m = 3s^{-1}$

76) . State the difference between "interference" and "diffraction" of waves. (2marks)

Solution

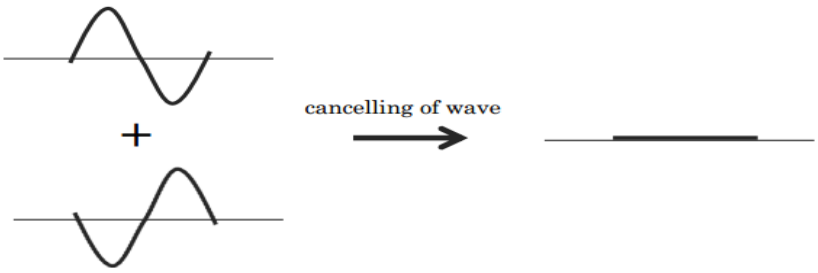
- Interference occurs when the waves travel in the same region resulting in either reinforcement or cancelling of each other. While diffraction occurs when straight wave hit an obstacle with a gap, the waves become curved on the other side and spread beyond the edges of the gap,

77) With the aid of a diagram, explain how destructive interference in water waves occurs. (4marks)

Solution

-

Destructive interference occurs when identical waves meet out of phase resulting in cancelling of each other and stopping of all movements.



➢

78) explain why waves refract when travelling from one medium to another. (2marks)

Solution

➢ Because speed of wave is different between different mediums.

79) A, state the difference between a ‘transverse’’ and a “longitudinal" wave. (2 marks)

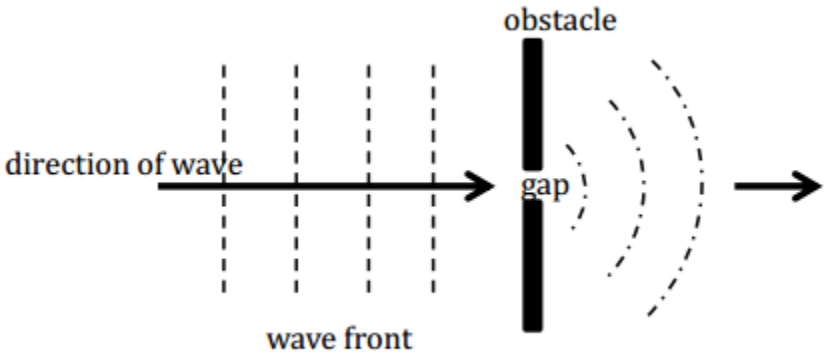
Solution

➢ A transverse wave is that the direction of the disturbance (vibrating particles) is at right angles to the direction of travel of the wave. A longitudinal wave is that the particles of the transmitting medium vibrate to and fro along the same line as that of wave motion

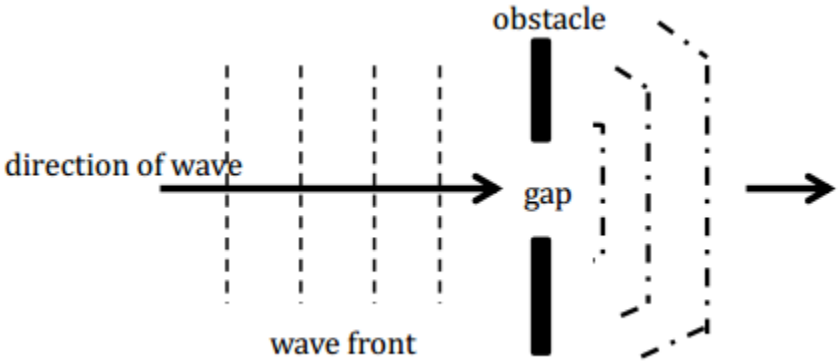
80) with the aid of labeled diagrams, explain the difference between waves passing through narrow and wide gaps. (6 marks)

Solution

➢ When waves pass through a narrow gap, they spread out more, i.e. More diffraction as demonstrated in the first diagram.



- When waves pass through a wide gap, there is less diffraction (spread out less) as shown in the second diagram.

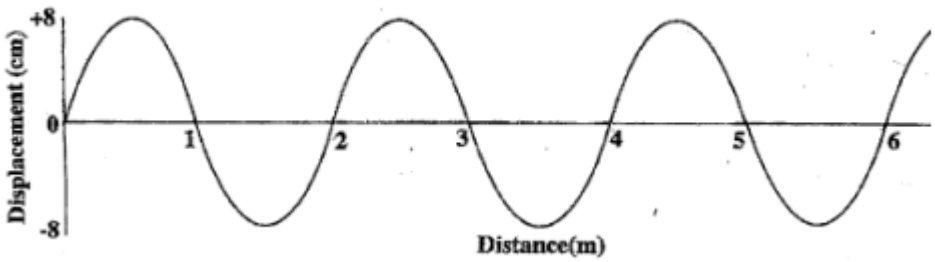


81) explain how constructive interference occurs in waves. (3 marks)

Solution

- When two or more waves meet in phase, the resultant wave has greater amplitude. This interference is called constructive interference

82) Figure 3 is a diagram of a wave with a frequency of 2 hz.



(i) Name the type of wave shown in figure 3. (1mark)

Solution

- Transverse wave

(ii) Give any two properties of the wave. (2marks)

Solution

- ***choose two answers from below.**
- - refraction,
- reflection,
- Diffraction,
- interference

(iii) What is the wavelength of the wave. (1marks)

Solution

- 2m

(iv) Calculate the speed of the wave. (2 marks)

- **Solution**

wave speed = wavelength × frequency

= 2 m × 2 Hz

= 4 m/s

4 m/s

-

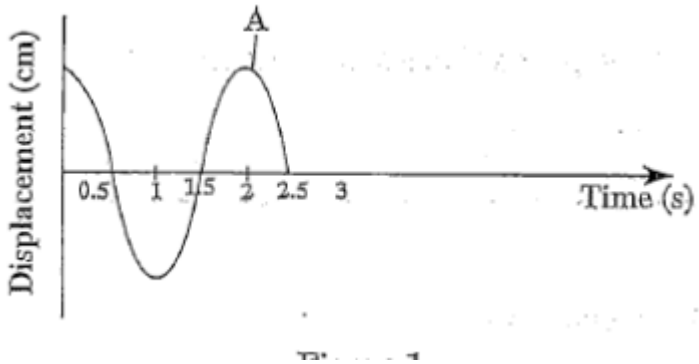
83) Give two factors that affect the frequency of a vibrating spring. (2marks)

Solution

- Mass on the spring

- Material of the spring

84) figure 1 is a diagram of a wave.



(i) Name the part labeled a. (1mark)

Solution

- Crest

(ii) Calculate the frequency of the wave. (2marks)

Solution

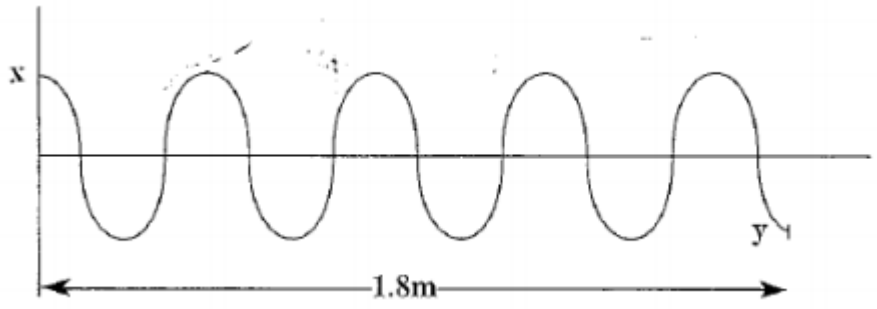
$$\text{Frequency} = \frac{\text{number of complete cycles}}{\text{time taken}} = \frac{1\text{cycle}}{2\text{s}} = 0.5\ \text{Hz}$$

(iii) Calculate the velocity of the wave if its wavelength is 50m. (2marks)

Solution

- Velocity = frequency × wavelength = 0.5hz × 50m = 25 m/s.

85) figure 4 is a diagram showing waves n a rope xy.



86) (i) calculate the wave length of this wave. (3marks)

Solution

$$\text{Wavelength} = \frac{\text{distance travelled by a wave}}{\text{number of comlete waves}}$$

$$= \frac{1.8\text{m}}{4\,^1/_2}$$

❖ $=0.4\text{m}$

87) (ii) if the rope xy is swung up and down 20 times in 2 seconds, calculate the average speed of the wave. (4marks)

Solution

$$\text{Frequency} = \frac{\text{number of complete cycles}}{\text{time taken}}$$

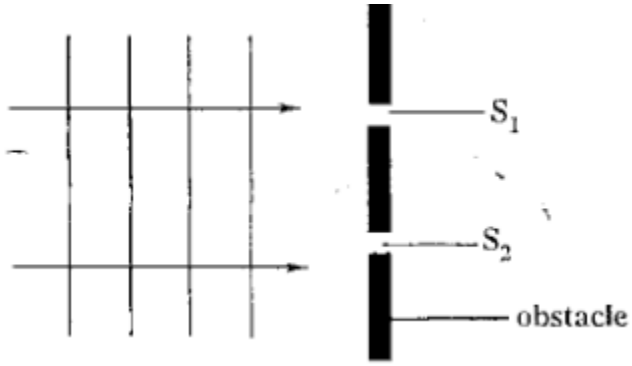
$$= \frac{20}{2} = 10\ \text{Hz}$$

$$\text{Speed of a wave} = \text{frequency} \times \text{wave lengh}$$

$$= 10\text{Hz} \times 0.4\text{m}$$

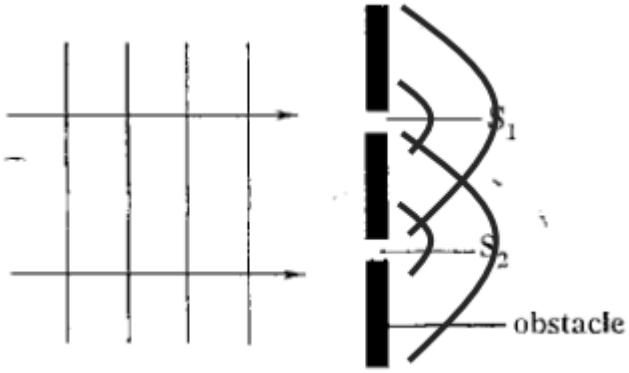
❖ $= 4\,\text{m/s}$

88) Figure 5 is a diagram showing water wave approaching two slits, s1 and s2 in an obstacle.



(i) Complete the diagram to show waves emerging on the other side of the obstacle. (3marks)

Solution



❖

(ii) State two properties of waves that are demonstrated in the completed diagram. (2marks)

Solution

- ❖ Diffraction and interference
- ❖ Diffraction will be insignificant, i.e. Not much diffraction will take place.

(iii) what would happen to the waves emerging on the other side of the obstacle if the widths of s1 and s2 were increased? (1mark)

Solution

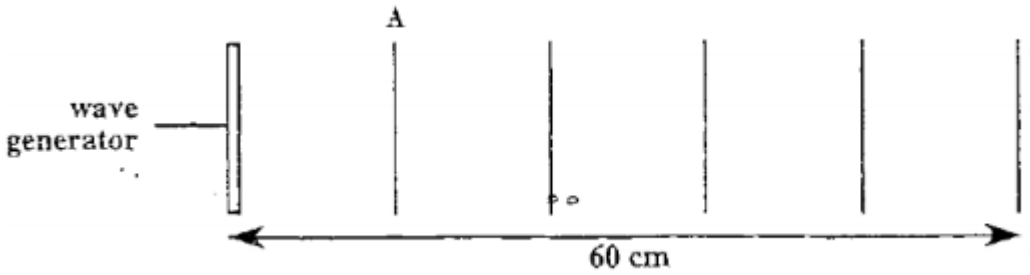
- ❖ At the point where a crest from one source arrives at the same time as crest from another source, a bigger crest is formed and the waves are said to be in phase. When the waves are in phase, it means there is constructive interference. This also happens when two troughs

collide. At the point where a crest and a trough arrive together, the waves are exactly out of phase and they cancel out (if their amplitudes are equal). When the waves are out of phase there is destructive interference.

89) Explain with the help of diagrams, the difference between constructive interference and destructive interference. (10marks)

Solution

90) Figure 6 is a diagram shooing crests of straight ripples on water surface produced in a ripple tank by wave generator.



91) What kind of waves is represented by the crests? (2marks)

Solution

- Transverse wave

92) what is the wavelength of the ripples if there are 5 complete waves in a distance of 60 cm? (2marks)

Solution

- Wave length = 60cm/5 = 12 cm = 0.12 m

93) . What is the frequency of the ripples if four crests pass through point a in one second? (1mark)

Solution

- Frequency = 4 / 1 second = 4 hz

94) calculate the speed of the waves. (3marks)

Solution

- Speed = frequency x wave length
  4 hz × 0.12m = 0.48 m/s

95) what would happen to the wave length if the waves moved from deep water to shallow water?

Solution

- The wave length would decrease.

96) explain the answer to (95). (5marks)

Solution

- When waves enter the shallower water, then speed of wave would decrease but frequency of wave doesn't change. So, wave length would decrease

97) Describe "constructive interference" in water waves. (2marks)

Solution

- Constructive interference is produced where crest and crest meets at same region. It makes the crests bigger.

98) what is the difference between "longitudinal" and "transverse" waves? (2marks)

Solution

- In a transverse wave, the objects move up and down about fixed position at right angle to the direction of movement of the wave. While in a longitudinal wave, the objects move in the direction of the wave.

99) what type of waves are radio waves? (1mark)

Solution

- Transverse wave

i) What is the difference between a transverse wave and a longitudinal ll waves?(4marks)

Solution

- Transverse waves can travel through a vacuum while longitudinal waves cannot. Transverse waves produce crests and though while longitudinal waves create compression and rare faction. Oscillations of transverse waves are at right angle in the direction of the waves while that of longitudinal waves are in line with direction of the waves.

(iii) Give any two characteristics of a wave. (2marks)

Solution

- Amplitude
- , wave length,
- Frequency,
- velocity,

(write any two of these)

light

100) explain how the focal length of a convex lens can be determined using a distant object. (3 marks)

solution

- Sunlight rays arrive in parallel beams. Using the window as an object, one can form a sharp, inverted image on a sheet of white card or white wall (acting as screen) by adjusting the convex lens between sunlight through window and the screen is the focal length

101) state any two differences between a “camera” and a “human eye”. (2 marks)

solution

- -the focal length of the human eye lens changes while that of the camera is fixed.

- -the human eye has a fixed image distance while the camera has an image distance that changes

102) (i) state any three differences between a real image and a virtual image. (3 marks)

solution

- A real image is the image projected through a lens, while a virtual image is not projected and *observed through a lens*
- - a real image is upside down, while a virtual image is upright.
- - a real image cannot be observed using concave lenses, while a virtual image can.

(ii) an object 6 cm long is placed 30 cm in front of a converging lens of focal length 10 cm. Use the lens formula to calculate

;

(1) Image distance (4 marks)

Solution

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

where $f = 10cm, u = 30cm$, hence the image distance $v = 15cm$

(2) Magnification of the object (2 marks)

Solution

$$\text{Magnification} = \frac{\text{image distance}}{\text{object distance}} = \frac{15}{30}$$

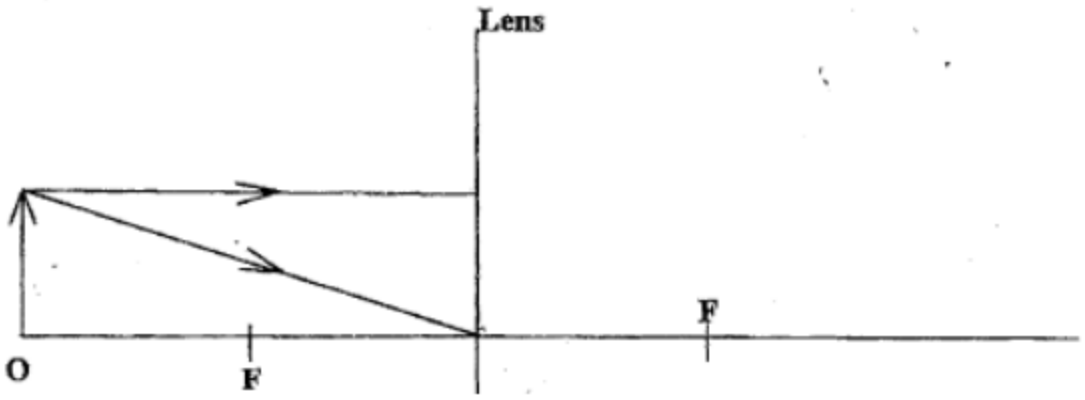
-

103) A. Explain how an image is formed by a convex lens. (4 marks)

solution

- Light rays from an object are bent towards the principal axis when passing through the convex lens. They converge at a certain point, where the image is produced.

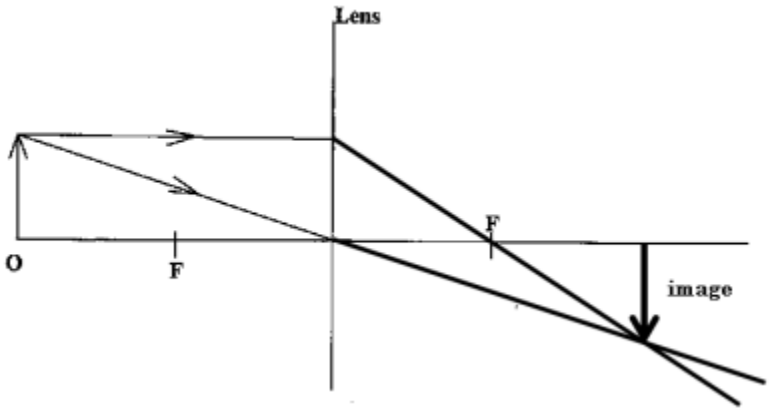
104) A. Figure 2 shows part of a ray diagram.



(i) Complete the ray diagram to show the position of the image. (3marks)

Solution

-



(ii) Calculate the magnification of the image. (4marks)

Solution

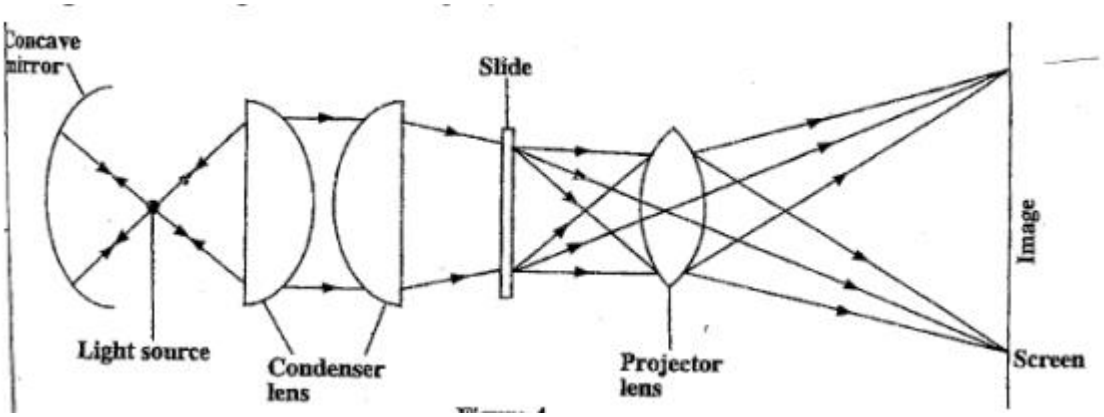
- The length of the object, h1 : 2cm
  The length of the image, h2 : 2cm

Magnification, m is

$$m = \frac{h_2}{h_1} = \frac{2cm}{2cm} = 1$$

oscillations and waves

105) figure 4 is diagram of a slide projector.



(i) State the function of each of the following:

concave mirror: (1mark)

solution

- Concave mirror:
  It reflects back the light rays that are directed away from light source so that the slide can get the brighter lights.

condenser lens: (1mark)

solution

- Condenser lens:
  It can converge and condense as much light as possible onto the slide, so as to illuminate it very well

(ii) describe the nature of the image formed on the screen. (3marks)

solution

- .

106) (i) define "focal length" of a convex lens. (2 marks)

solution

- ❖ Focal length is the distance between the optical centre and the principal focus

(ii) State any two ways of determining the focal length of a convex lens. (2 marks)

Solution

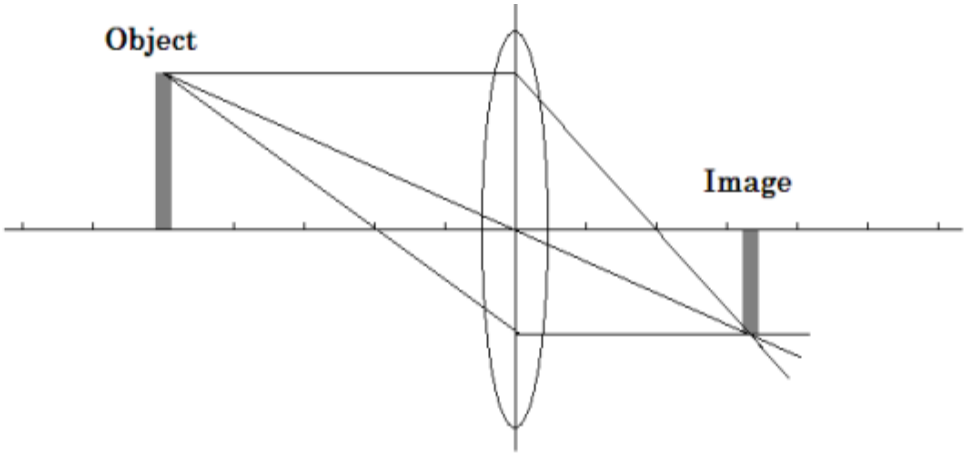
A convex lens forms a real image of a real object. If you measure the image distance (v : the distance from image position to centre of lens) and the object distance (u : the distance from object position to centre of lens), the focal length can be determined by using the following equation

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} .$$

F: focal length, v: image distance, u: object distance

(iii) an object 10 cm high is placed 25 cm from the centre of a convex lens of focal length 10 cm. Draw a ray diagram to show the position of the image formed. (scale: 1 cm to represent 5 cm) (6 marks)

solution



107) (i) state any three similarities between a camera and a human eye. (3marks)

solution

- ❖ An eye uses a light sensitive retina as its screen and a camera uses a light sensitive film as its screen.
- ❖ An eye has a converging lens (convex) and a camera has a converging lens too.
- ❖ The iris controls light entering the eye and the shutter/diaphragm controls light entering a camera.
- ❖ Both use light in their operations.
- ❖ Inside surface area of an eye is black (dark) just the same as i the camera.

(iii) What is the function of an aperture in a camera? (1mark)

Solution

- ❖ It is a hole in the diaphragm that lets in light.

108) An object placed 15 cm away from a convex lens of focal length 10 cm.

(i) Using the lens formula, calculate the image distance. (4marks)

Solution

- ❖ Object distance(u)=15cm, focal length (f)=10cm

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$$

$$\frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{10}-\frac{1}{15}=\frac{1}{30}$$

$$\frac{1}{v}=\frac{1}{30}$$

∴ Image distance is 30cm

(ii) Calculate the magnification of the image. (2marks)

Solution

$$\text{Magnification}=\frac{v}{u}=\frac{30cm}{15cm}=2$$

❖

(iii) what is the nature of the image produced? (3marks)

solution

- ❖ Magnified,
- ❖ Real and
- ❖ inverted (upside down)

109) An object 2 cm high is placed 7.5 cm in front of a converging lens of focal length 5 cm.

(i) Calculate the image distance. (4 marks)

Solution

❖

Lens formula is

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$$

where f is focal length, u is object distance and v is image distance.

$$\frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{5}-\frac{1}{7.5}$$

$$=\frac{3}{15}-\frac{2}{15}=\frac{1}{15}$$

$$\frac{1}{v}=\frac{1}{15}$$

$$\therefore v = 15\text{cm}$$

Try the following from above infomation

(ii) Describe the image formed. (3 marks)

Solution

❖

(iii) Calculate the magnification of the image. (2 marks)

Solution

LIST OS REFERENCE

➢ *MSCE MANEB Questions with their solutions*

- *KEITH WALLIS Book 1 and 2*
- *SAMUEL KALEA*
- *JAPAN OVERSEAS COOPERATION VOLUNTEERS*
- *MANEB QUESTIONS*