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PHYSICS

PAPER 1 3117/1

Thursday **28 MAY 2009** 12 NOON. – 1.15 P.M.

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Do not open this booklet until you are told to do so.

All answers are to be recorded in this booklet.

Write your school number, candidate number, surname and initials in the spaces provided at the top right-hand side of this booklet.

There are fifty questions on this paper. Answer as many questions as you can. For each question, four possible answers, A, B, C and D are given.

Choose the one you consider correct and circle the **LETTER** of your choice in the booklet.

Rough work paper should not be handed in.

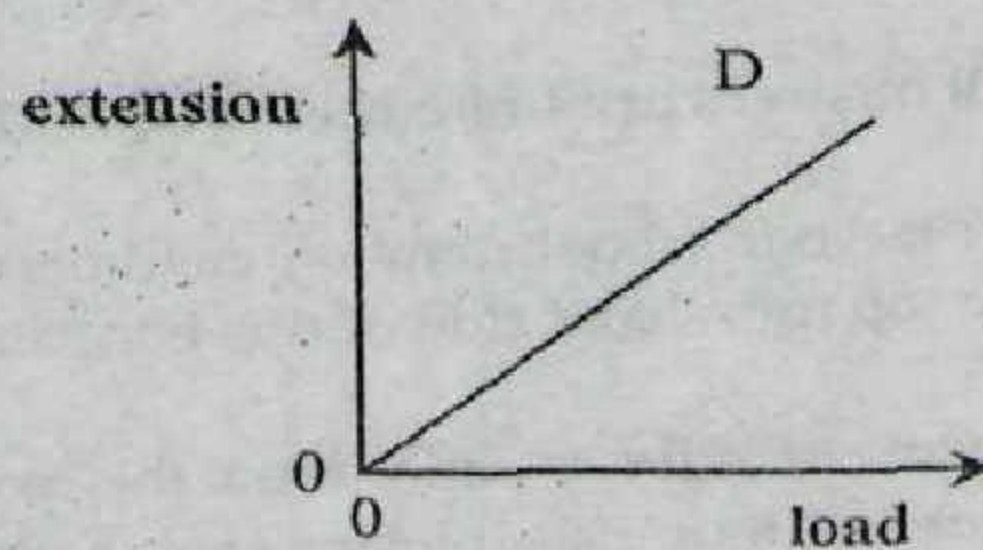
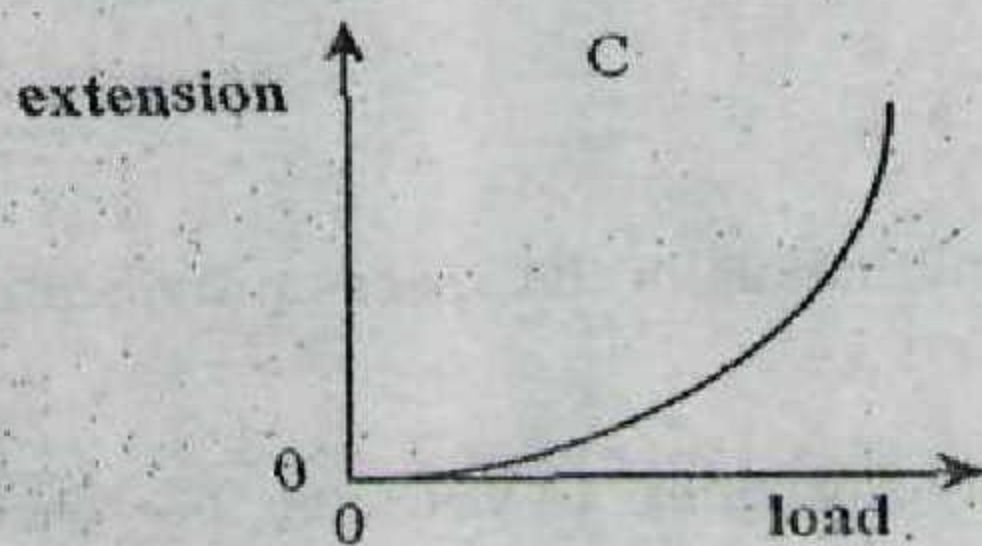
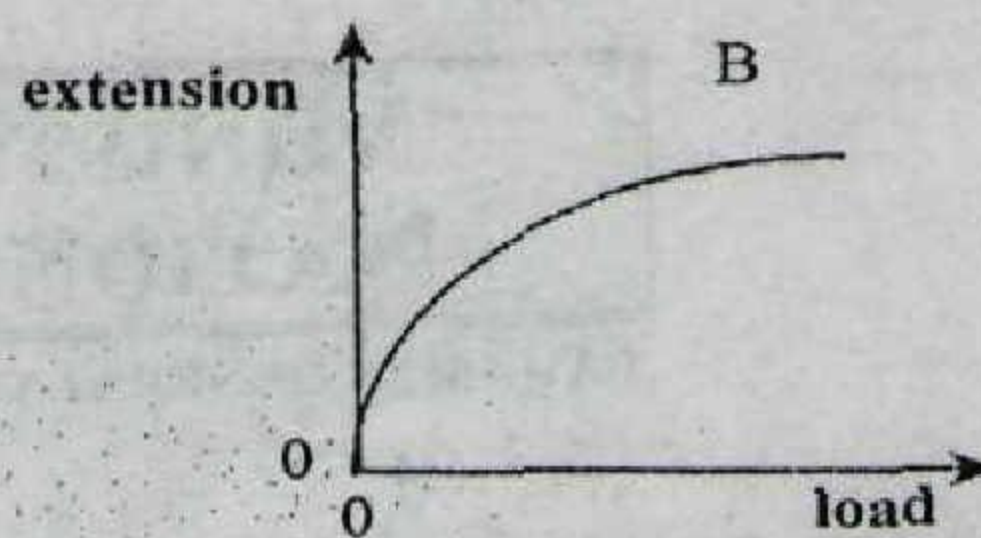
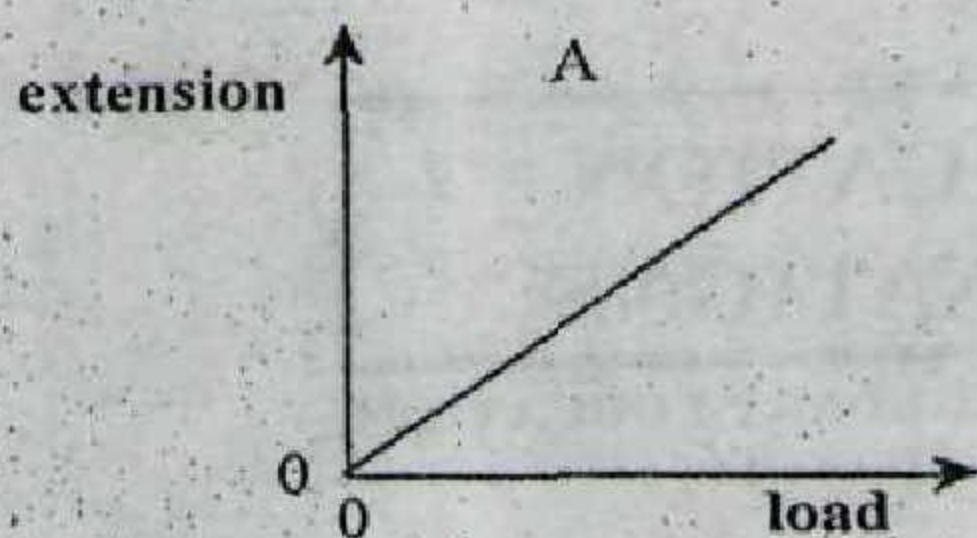
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This question paper consists of 24 printed pages and 4 blank pages.

1. Which row shows the quantity with its correct S. I. unit?

	quantity	S.I. unit
A	length	centimetre
B	mass	gram
C	time	second
D	weight	pound

2. Which graph correctly shows load and extension for a spring stretched beyond its elastic limit?

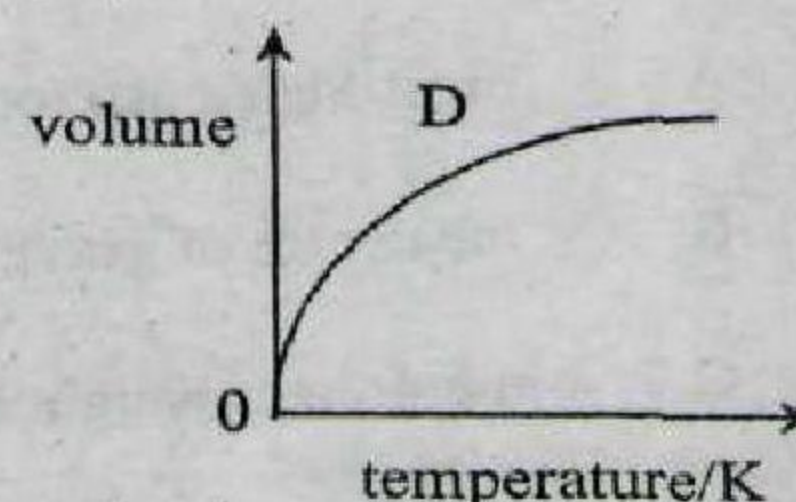
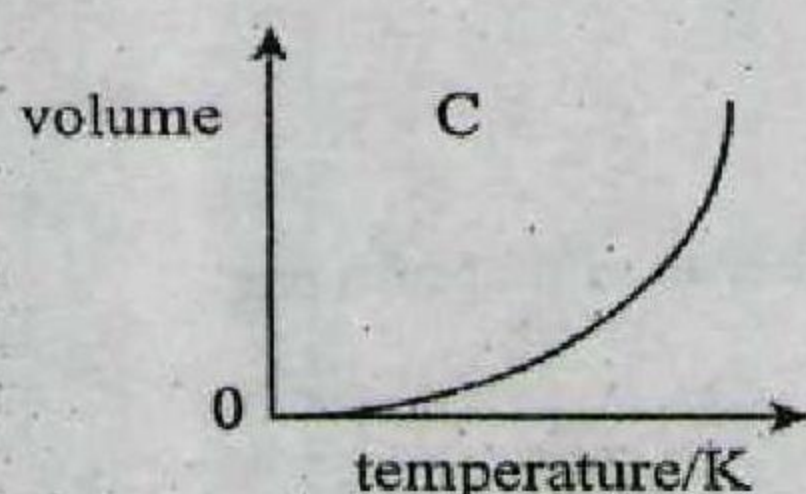
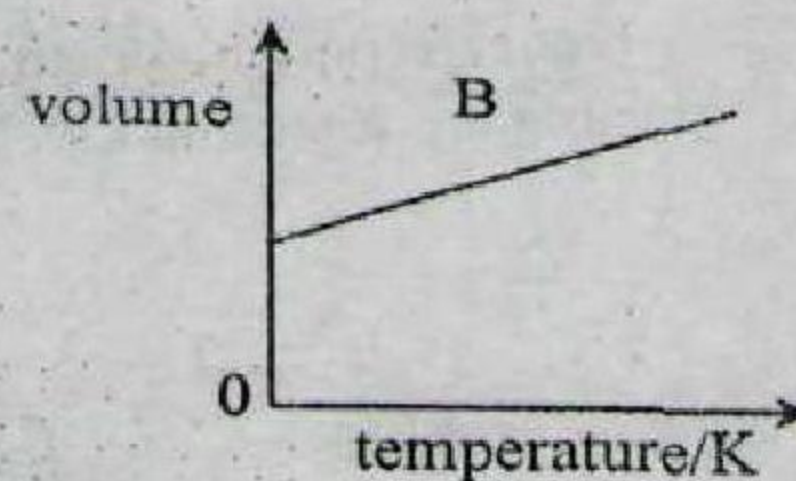
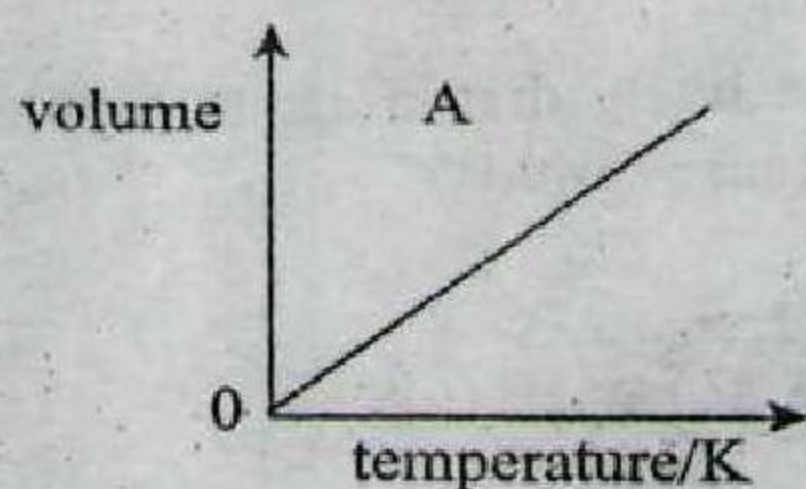


3. A recent report noted that SUVs were more likely than a car to topple over when turning a corner quickly. What is a possible cause for this?

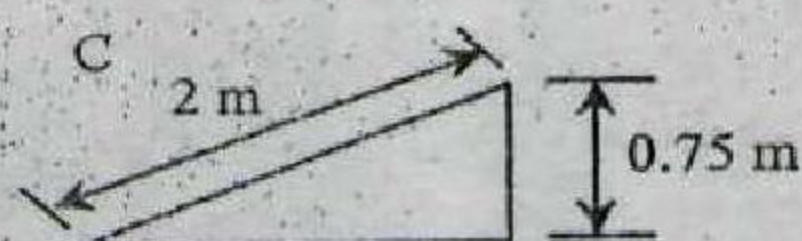
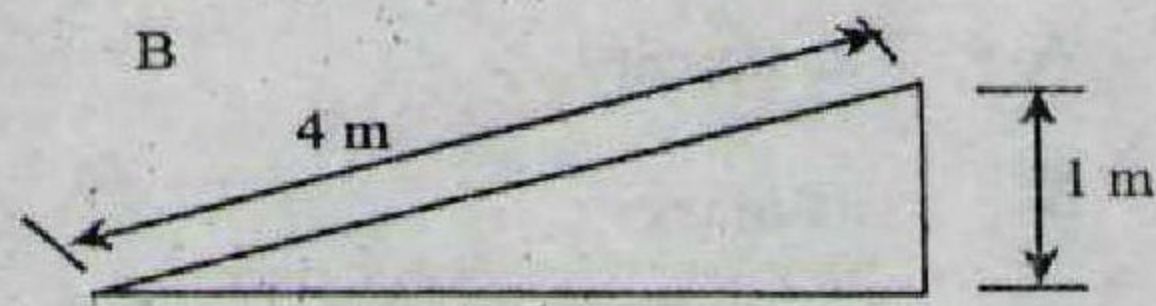
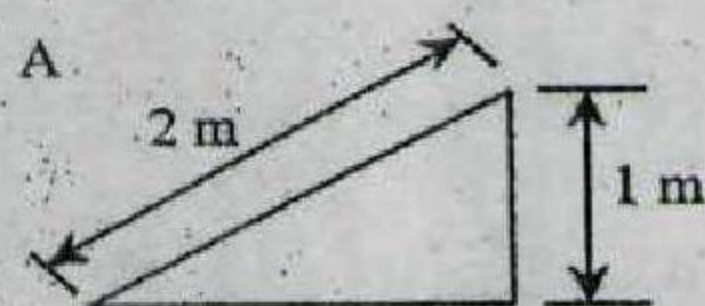


- A most SUVs use four wheel drive
- B the centre of gravity of an SUV is higher than that of a car
- C the greater weight of the SUV
- D the larger size of the SUVs' tyres
4. An astronaut takes a building block to the Moon, where the acceleration due to gravity is less than on Earth. Which property of the block changes?
- A its density
- B its mass
- C its volume
- D its pressure

5. Which graph shows how the volume of a fixed mass at constant pressure varies with its temperature in Kelvin?



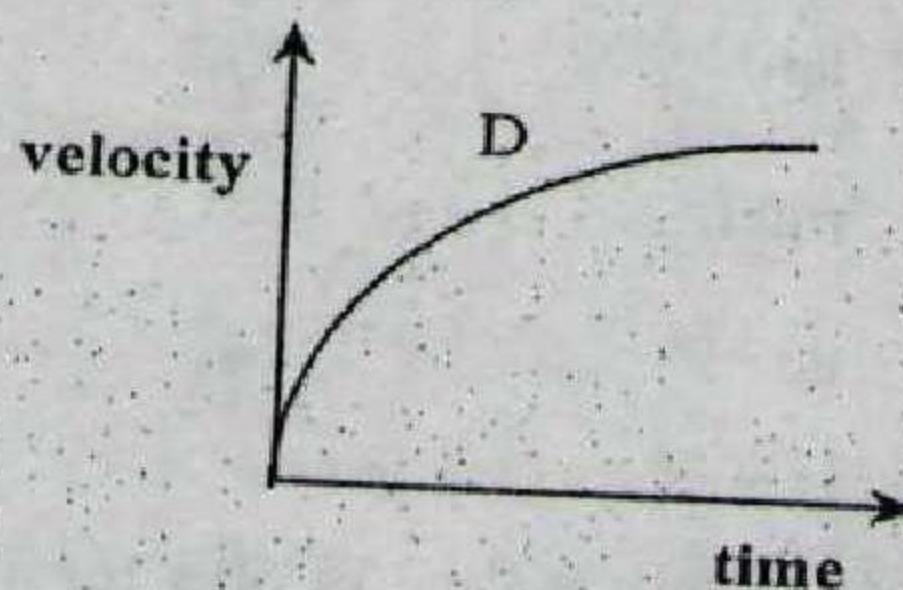
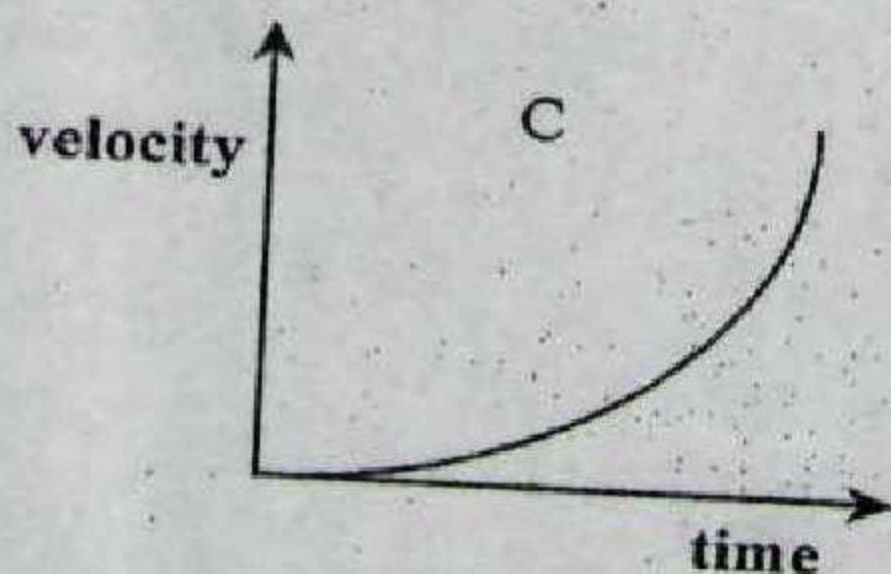
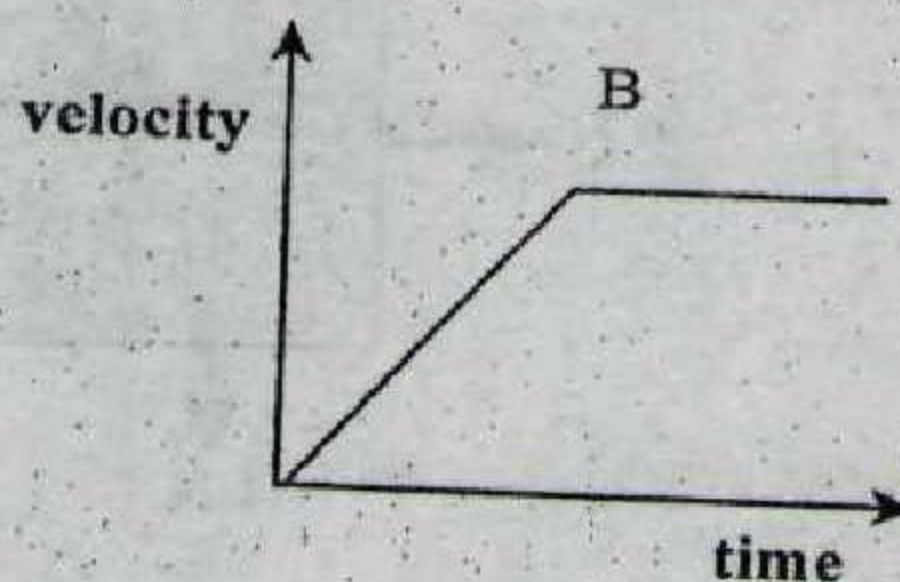
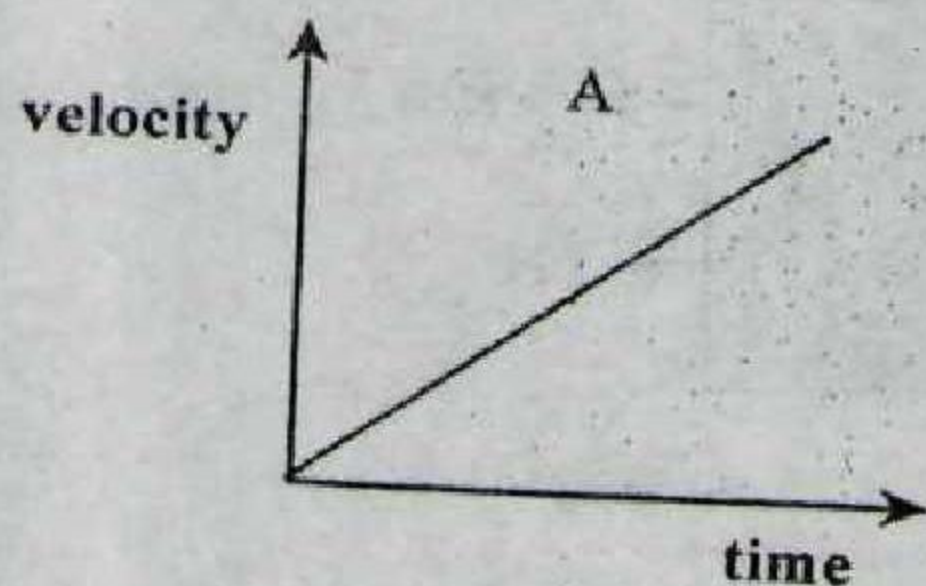
6. Which inclined plane will most likely make it easiest to push a loaded trolley from the ground to the top of the plane?



7. Which physical quantity is calculated by the product of mass and acceleration (mass $\times$ acceleration)?

- A acceleration
- B force
- C momentum
- D velocity

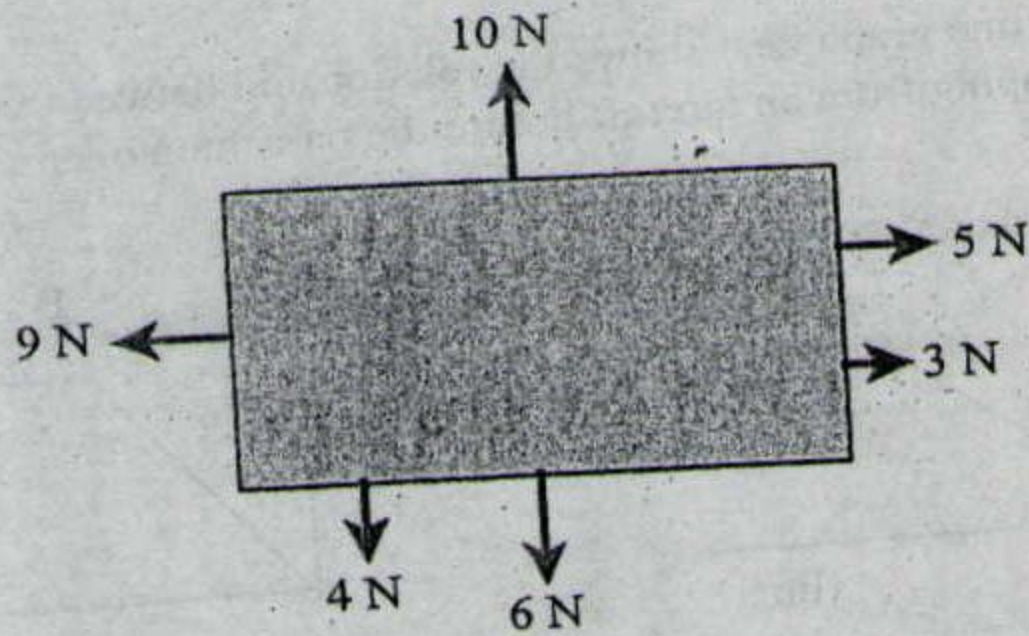
8. Which velocity/time graph best shows the relationship between velocity and time for a parachutist jumping from an aircraft before the parachute opens?



9. Which variable is a vector quantity?

- A energy
- B speed
- C velocity
- D work done

10. The forces shown on the object in the diagram cause it to accelerate. In which direction will it accelerate?

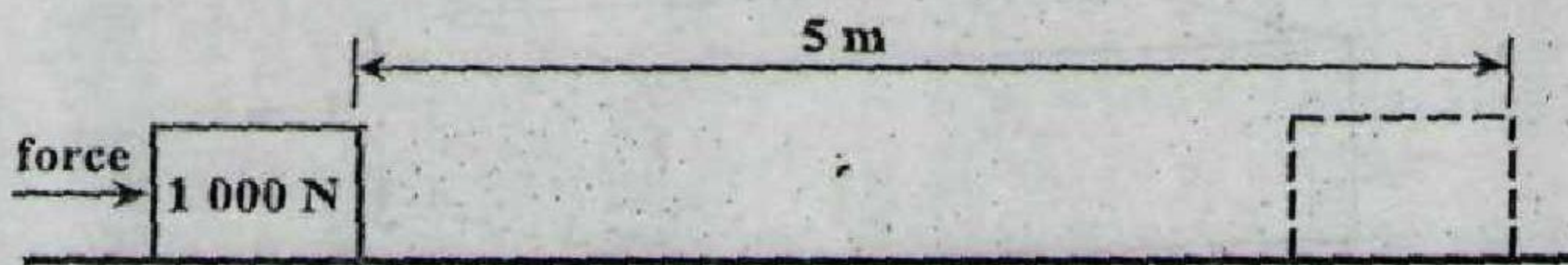


- A down
- B left
- C right
- D up

11. A timer records a time of 50 s for a runner in a 400 m race. What is the runner's average speed?

- A 0.125 m/s
- B 8.0 m/s
- C 10.0 m/s
- D 20 000 m/s

12. A crate weighing 1 000 N is pushed through a horizontal distance of 5 m at constant speed.

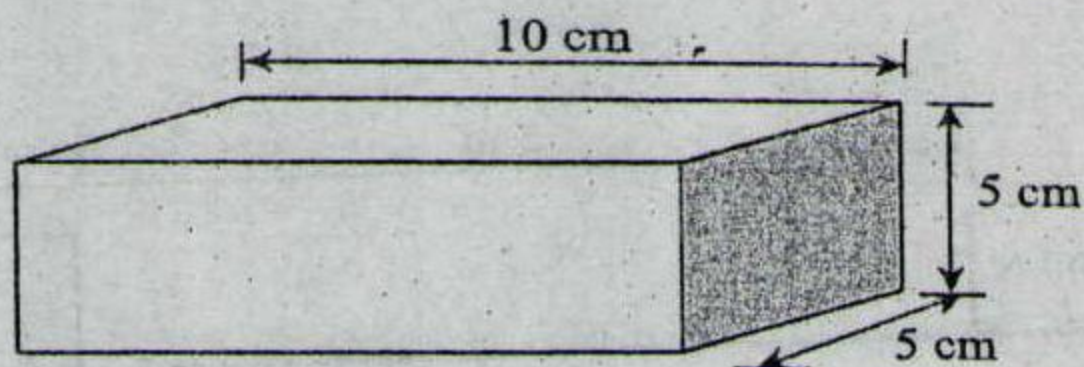


If 2 000 J of work is done in moving the crate, what force was used to push the crate?

- A 200 N
- B 400 N
- C 1 000 N
- D 2 000 N
13. Why do heavy goods vehicles often have more than two rear wheels?
- A to provide a smaller force on each tyre
- B to provide a larger force on each tyre
- C to provide a larger area of tyre contact with the road
- D to provide a higher pressure to improve grip
14. A man measures the air pressure in his car's tyres before starting a long journey. At the end of his trip he found the tyre pressures to be greater than at the start of the journey. What has caused this increase in pressure?
- A air molecules are moving faster
- B expansion of air molecules
- C increase in the number of air molecules
- D increase in the volume of air molecules

15. Calculate the density of the 200 g block shown.

Use the equation: $\text{density} = \frac{\text{mass}}{\text{volume}}$



- A 0.8 g/cm³
- B 1.25 g/cm³
- C 4.0 g/cm³
- D 8.0 g/cm³

16. Water is cooled from 4°C to 1°C. How will its density and volume change?

	density	volume
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

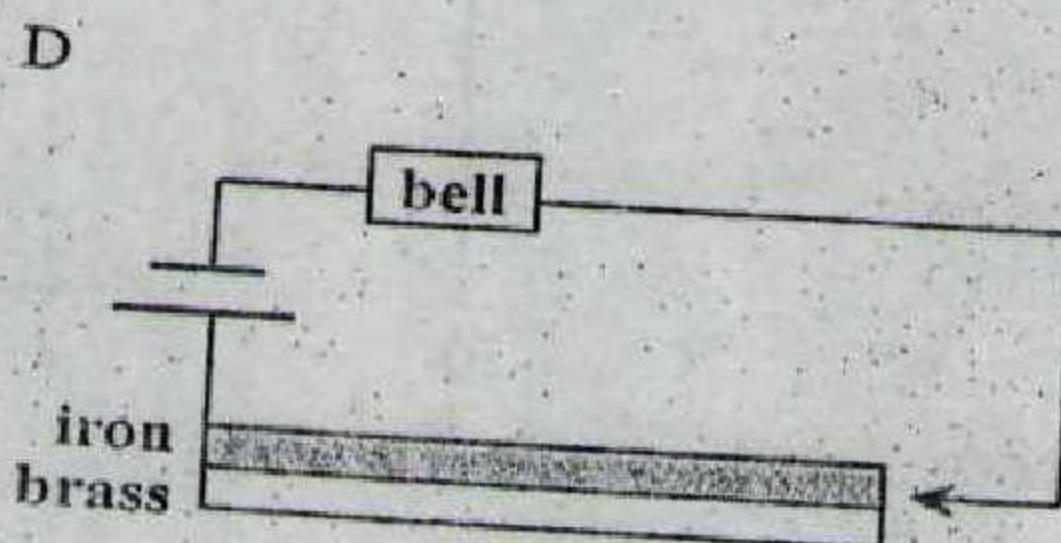
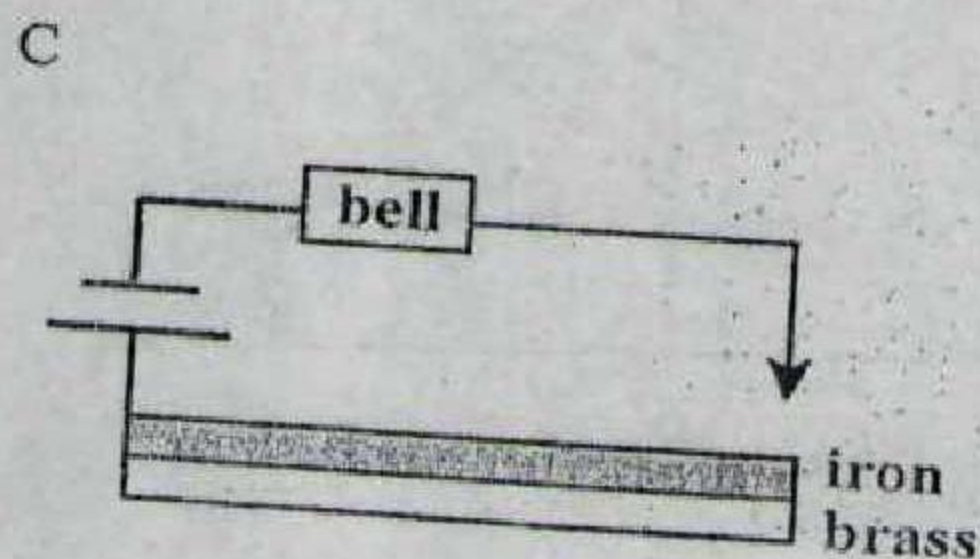
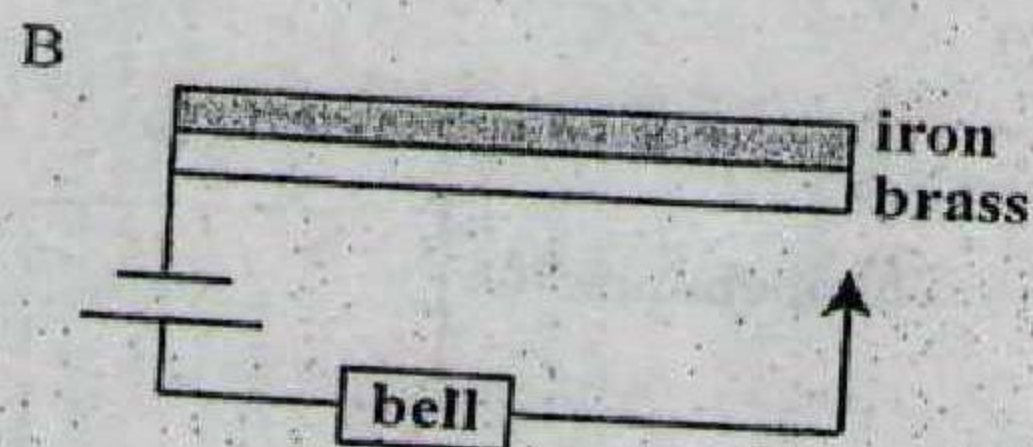
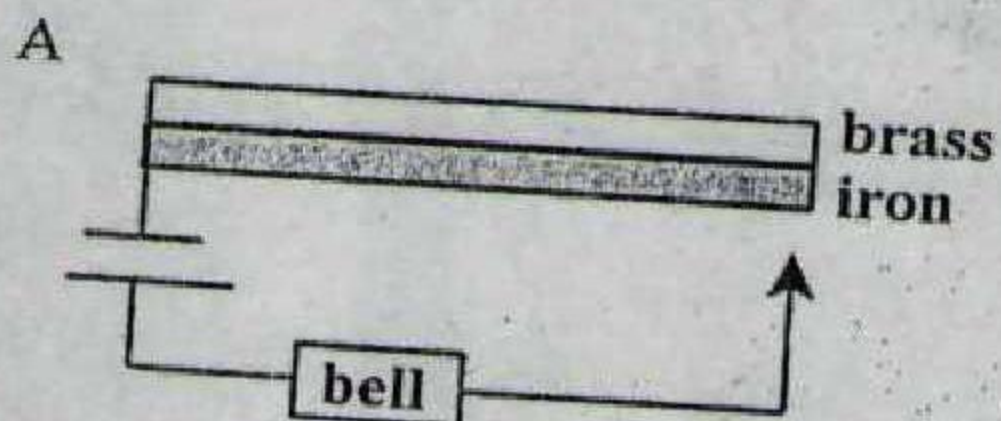
17. The fuel tanks stored at Lynden Pindling International Airport are painted silver. Which method of heat transfer does this reduce?

- A conduction only
- B convection only
- C conduction and convection
- D radiation only

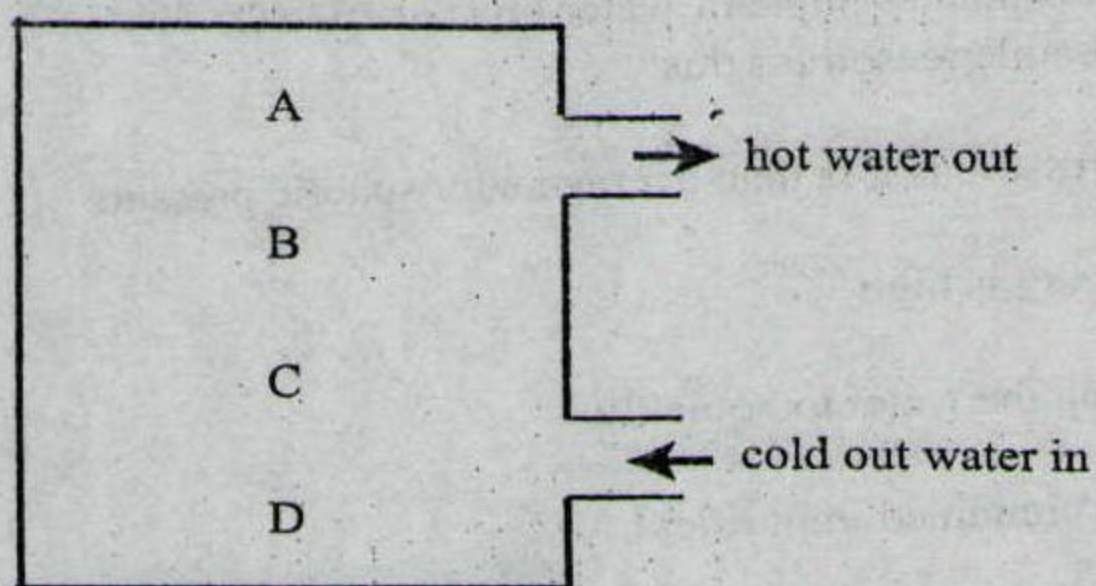
18. A student finds that a sample of water boils at 103°C . What is a possible reason for this?

A air pressure is less than average atmospheric pressure
B humidity is high
C heating the water too quickly
D water contained impurities

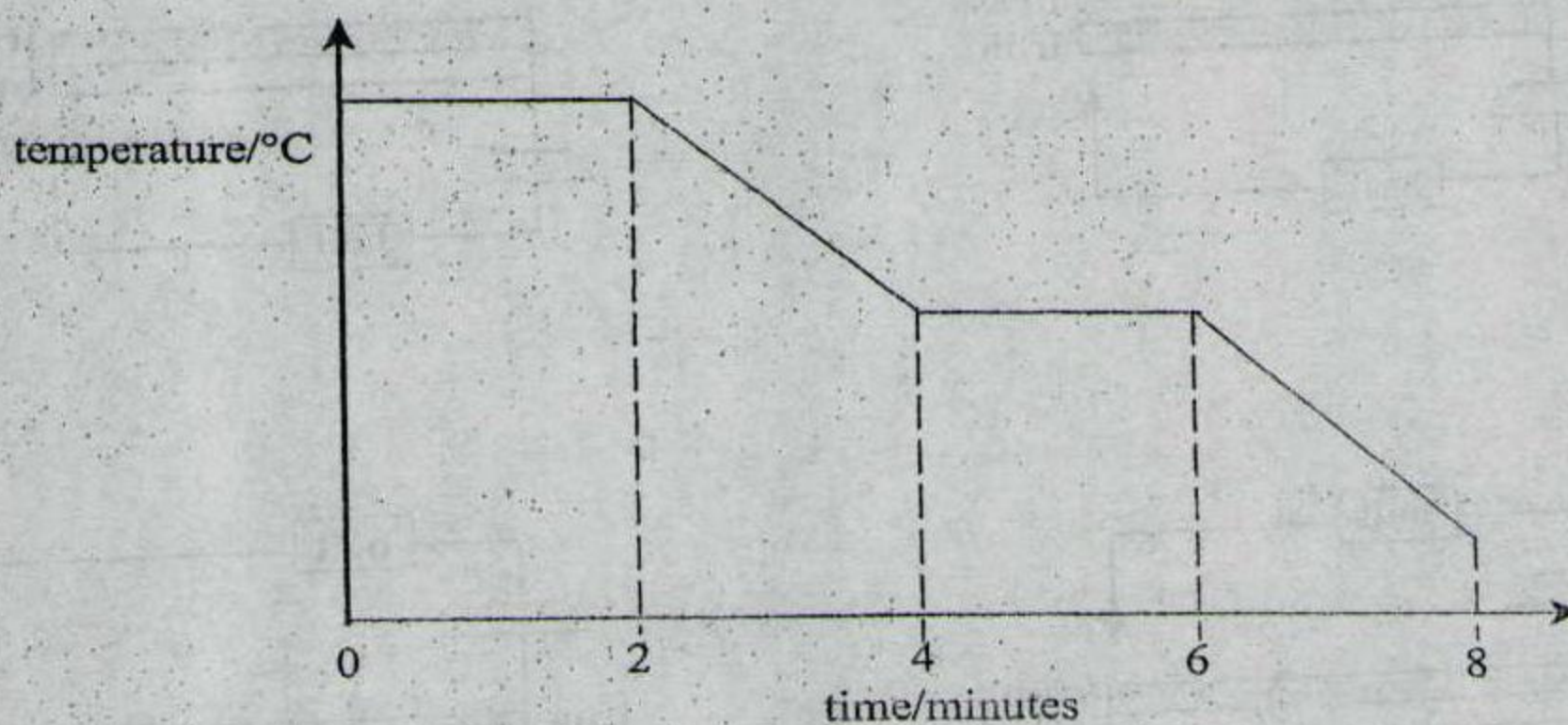
19. The diagrams show different attempts to use a bi-metallic strip in a fire alarm. Which current will cause the alarm bell to ring in the event of a fire or a temperature increase?



20. The diagram shows an electric water heater. What is the best position for the heating element if a small quantity of hot water is required quickly?



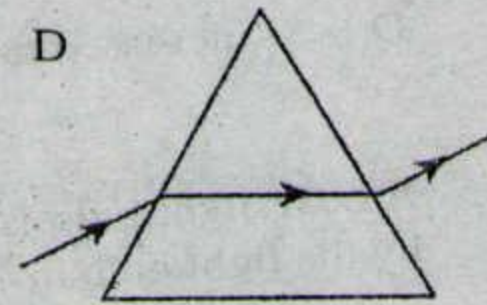
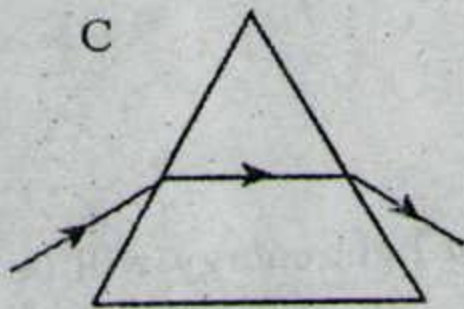
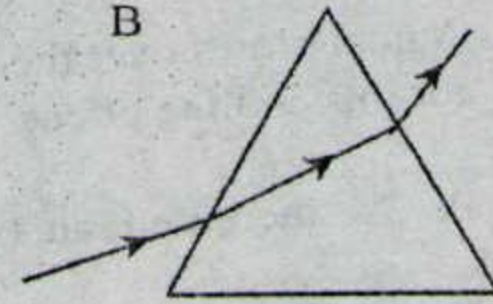
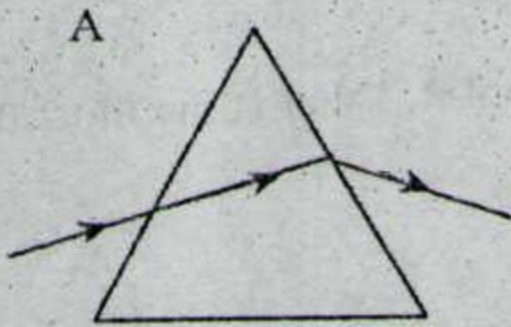
21. The graph shows a cooling curve for a substance which starts in the gaseous state. During the 8 minutes shown, the substance first condenses and then solidifies. At what time had all the gas condensed into a liquid?



- A 2 minutes
B 4 minutes
C 6 minutes
D 8 minutes

22. A man blows over the top of a hot cup of tea to cool it. What is the most likely cause for this cooling effect?
- A increased rate of conduction
 - B increased rate of convection
 - C increased rate of evaporation
 - D increased rate of radiation
23. A 60W light bulb is 5% efficient. How many Joules of light energy will be released by the light bulb in 1 second?
- A 3 J
 - B 5 J
 - C 12 J
 - D 60 J
24. Which of the following examples is considered to be an example of potential energy?
- A elastic energy
 - B light energy
 - C kinetic energy
 - D sound energy

25. Which diagram shows the path for a ray of red light passing through the prism?



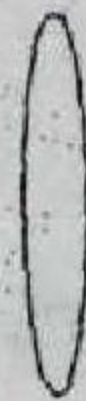
26. A red and white striped tee shirt is viewed in red light. What colour would it appear to be?

- A red and black
- B red and white
- C solid black
- D solid red

27. A student uses a converging lens to project an image of a distant object on to a screen.



distant object



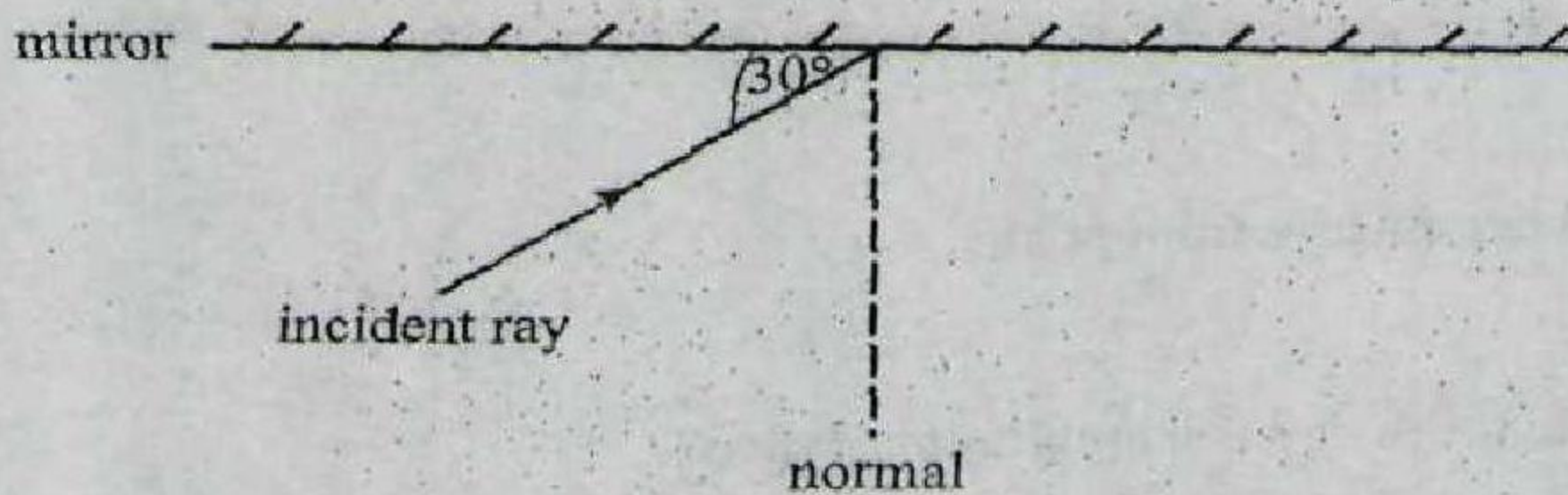
lens



screen

Which of the following image properties describe the image observed by the student?

- A real, diminished and upright
 - B real, diminished and inverted
 - C real, magnified and inverted
 - D virtual, diminished and inverted
28. The diagram shows a light ray incident upon a plane mirror at 30° to the mirror.



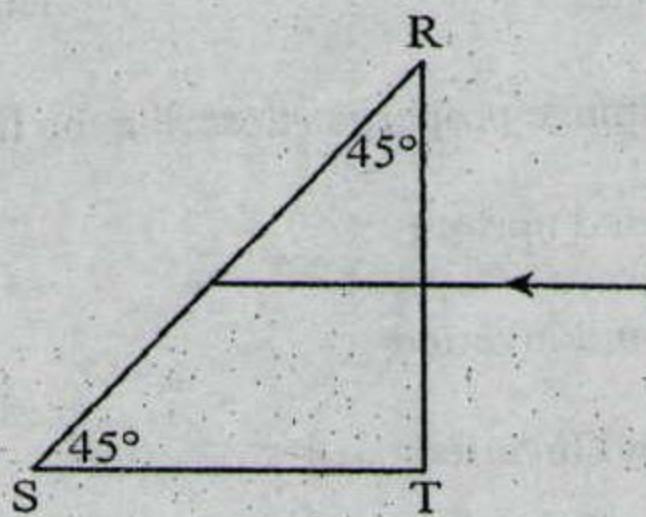
What will be the angle of reflection?

- A 0°
- B 30°
- C 60°
- D 90°

29. Which of the following instruments uses optical fibres?

- A Anemometer
- B Barometer
- C Endoscope
- D Seismograph

30. A light ray enters a $45^\circ - 90^\circ - 45^\circ$ prism along a normal line as shown.



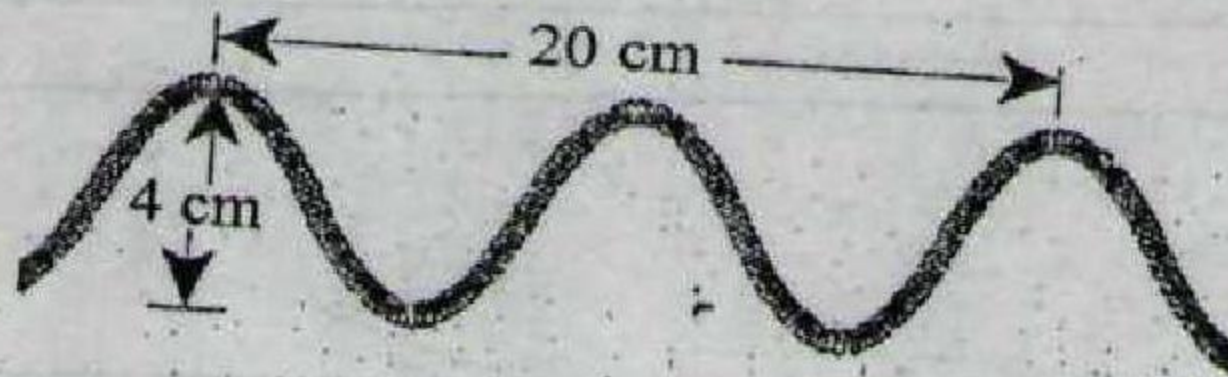
From which face does the light ray emerge, if any?

- A RT
- B RS
- C ST
- D will not emerge from prism

31. Which of the following is a longitudinal wave?

- A infra-red
- B radio-waves
- C sound
- D X-rays

32. The diagram shows a cross-section of water waves.

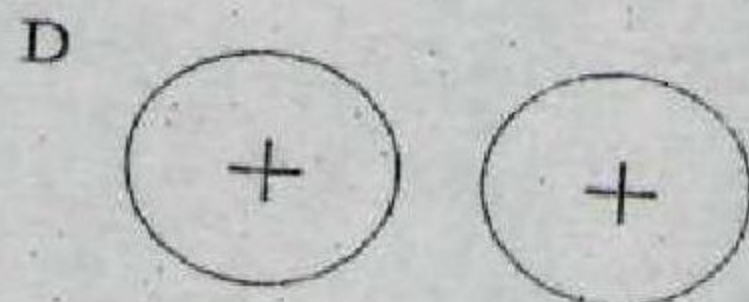
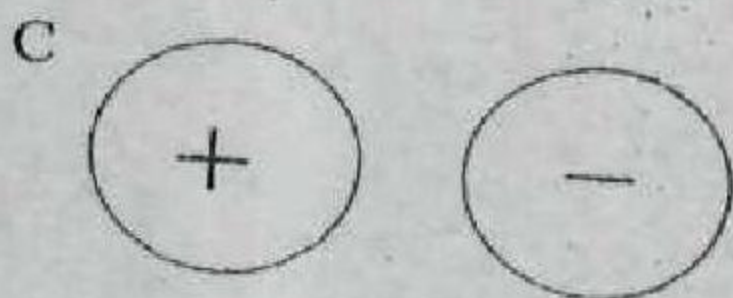
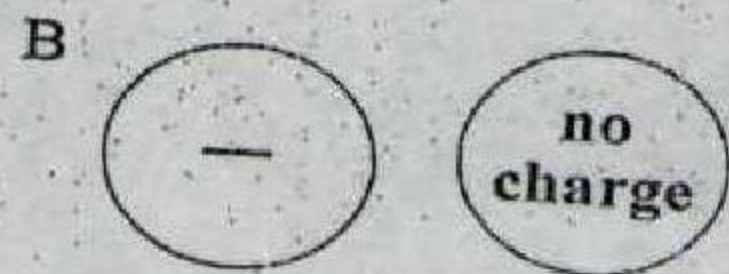
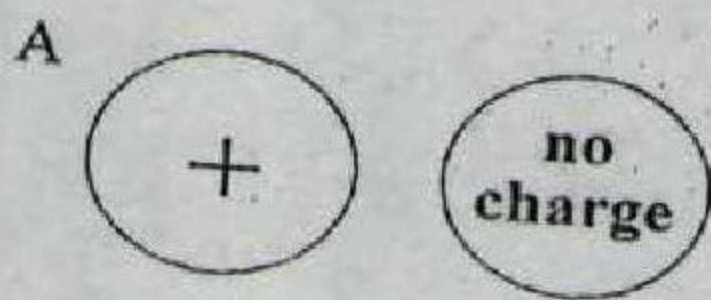


What is the wavelength of the wave?

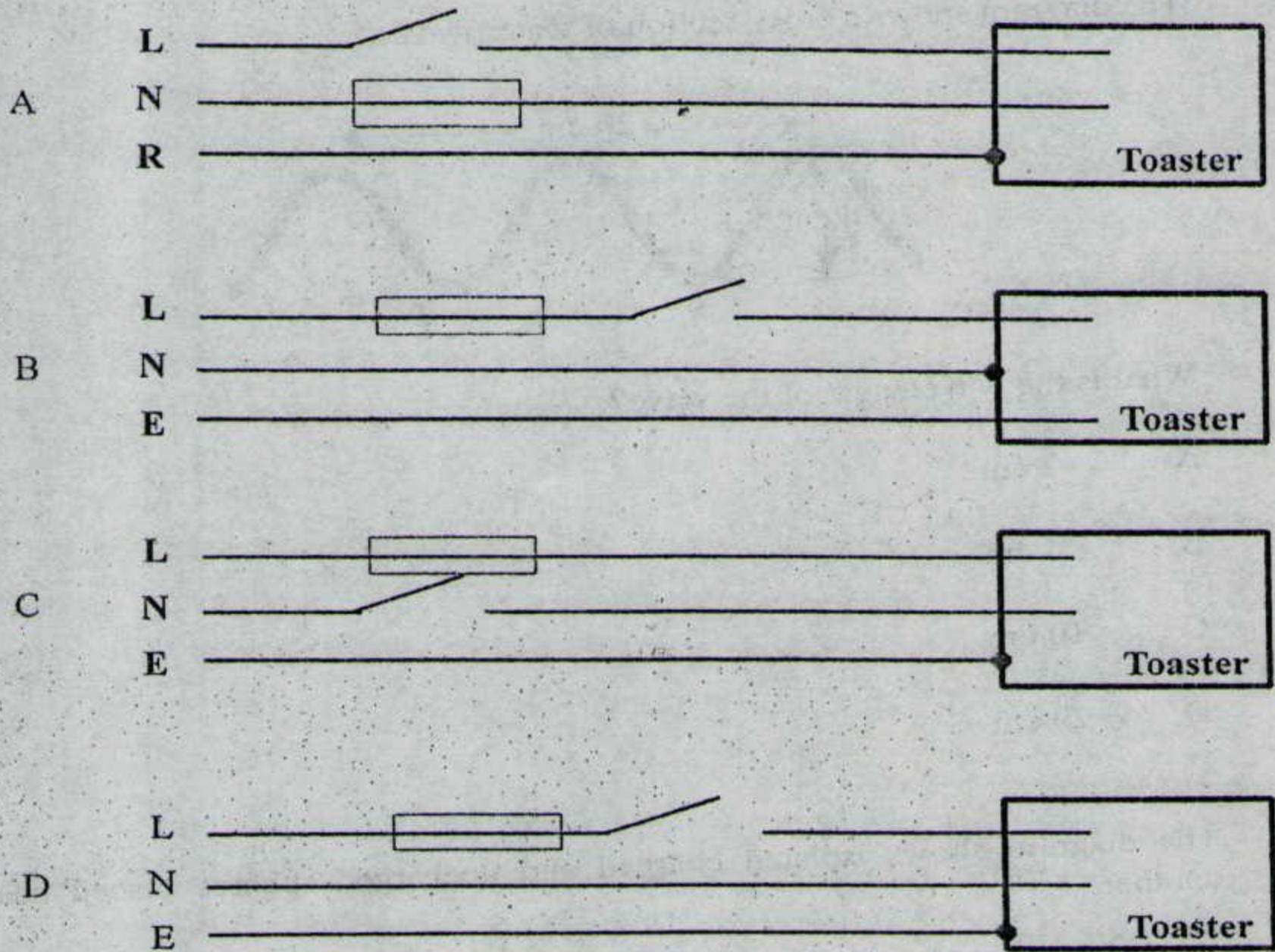
- A 2 cm
- B 4 cm
- C 10 cm
- D 20 cm

33. The diagram shows isolated charged and uncharged spheres placed near to one another.

In which example will the spheres repel one another?

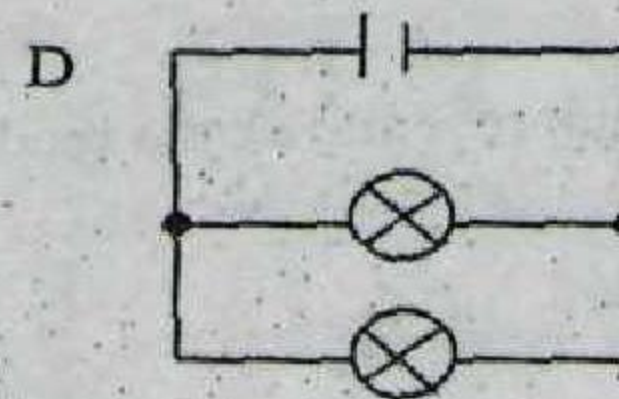
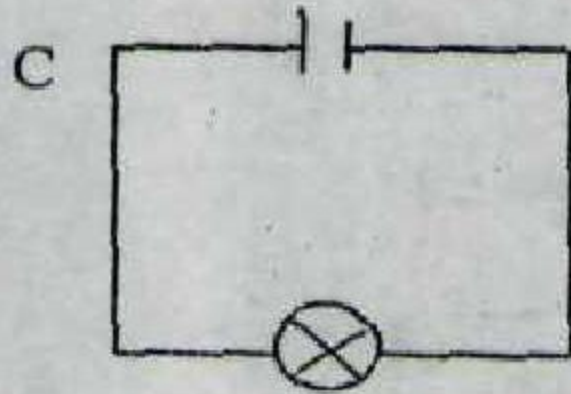
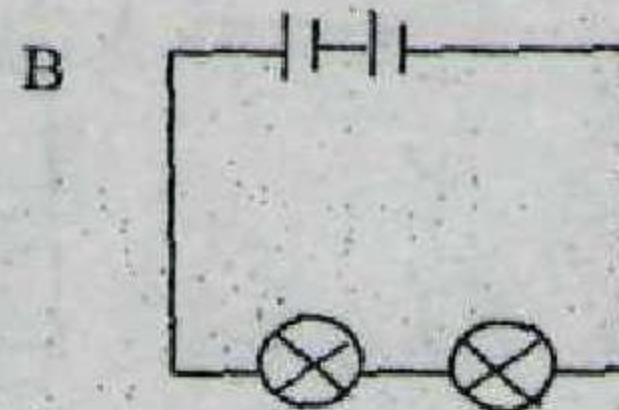
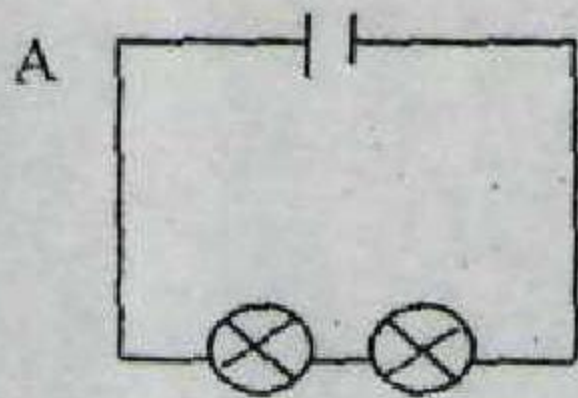


34. A metal-cased toaster is to be connected to the mains. Which diagram shows the correct wiring and placing for the switch and fuse?

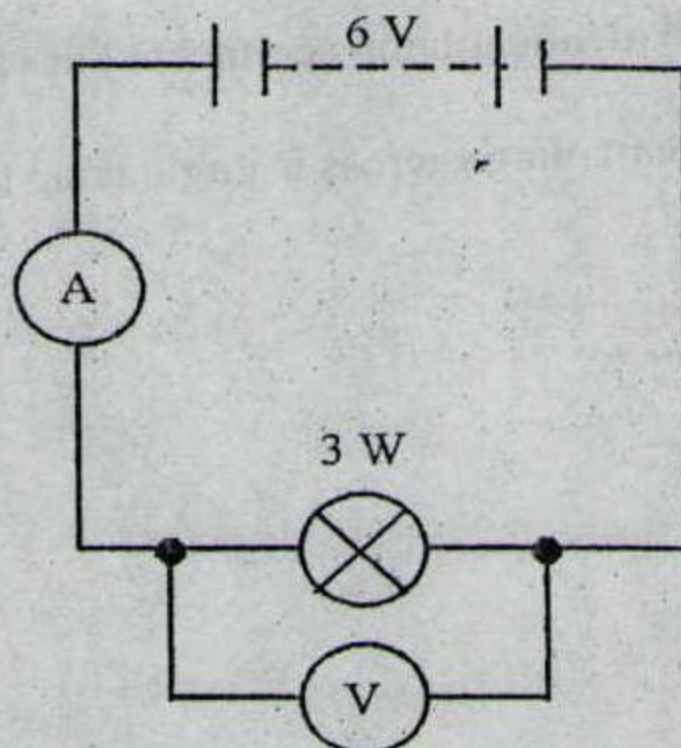


35. The circuits show two identical lamps connected in various ways to either one or two 2 V cells.

In which circuit will the voltage across a single lamp be 1 V?



36. The diagram shows a circuit consisting of a 6 V battery, 3 W lamp, ammeter and a voltmeter.



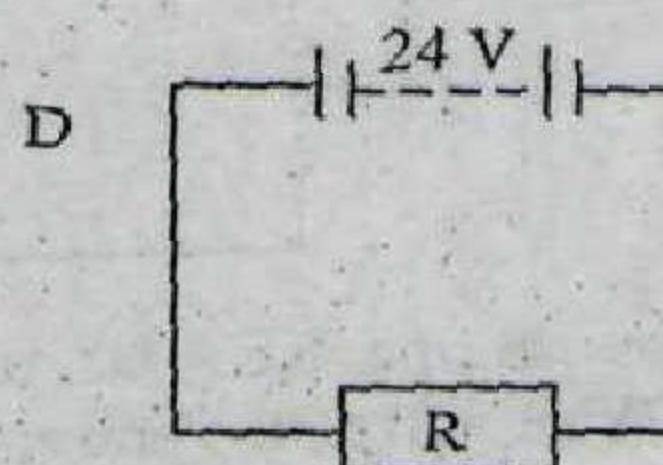
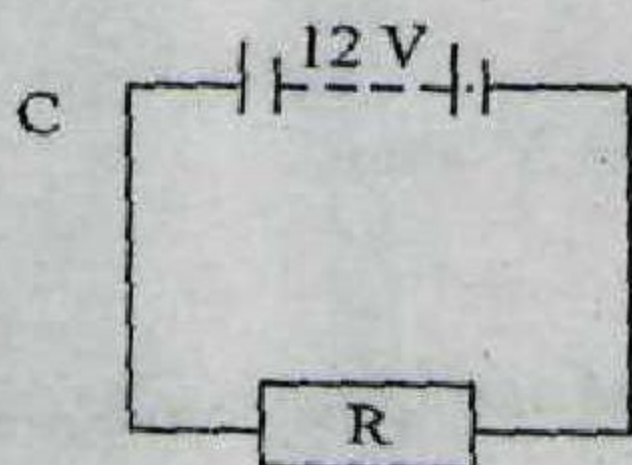
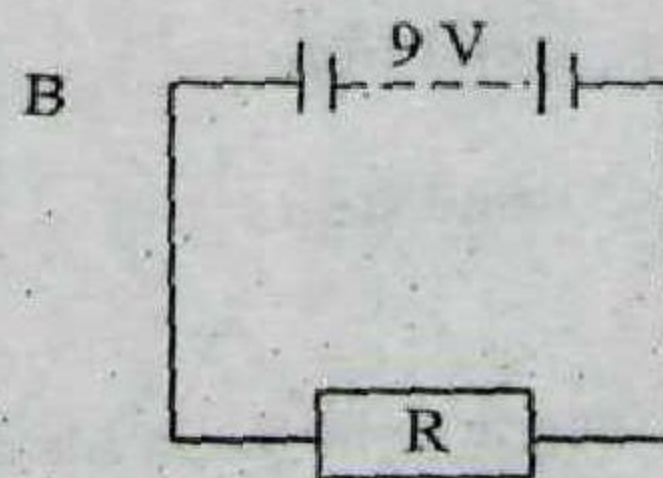
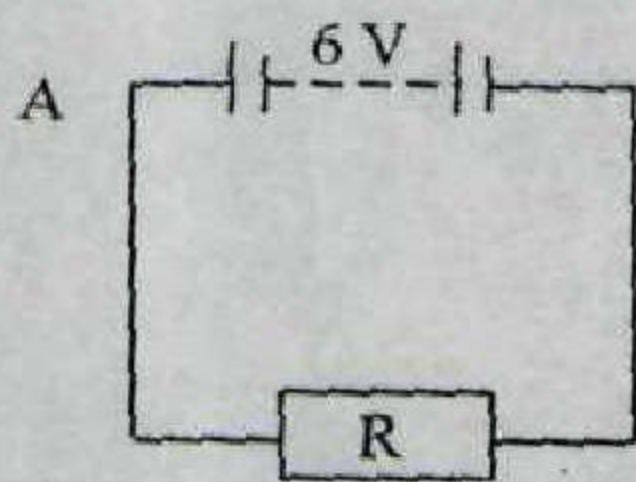
Which row shows the readings for the ammeter and voltmeter?

	ammeter	voltmeter
A	0.5 A	3 V
B	0.5 A	6 V
C	2.0 A	3 V
D	2.0 A	6 V

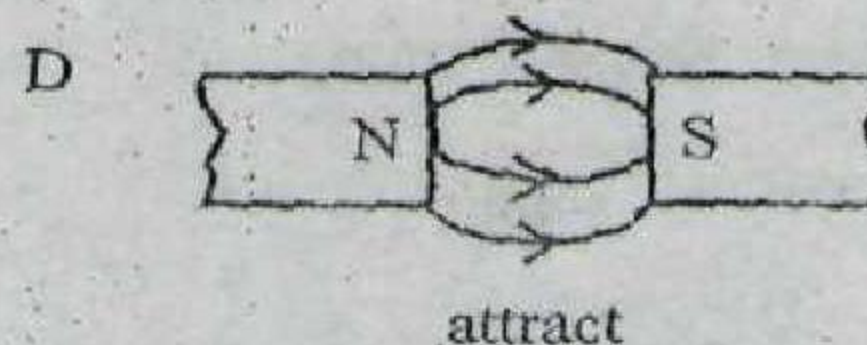
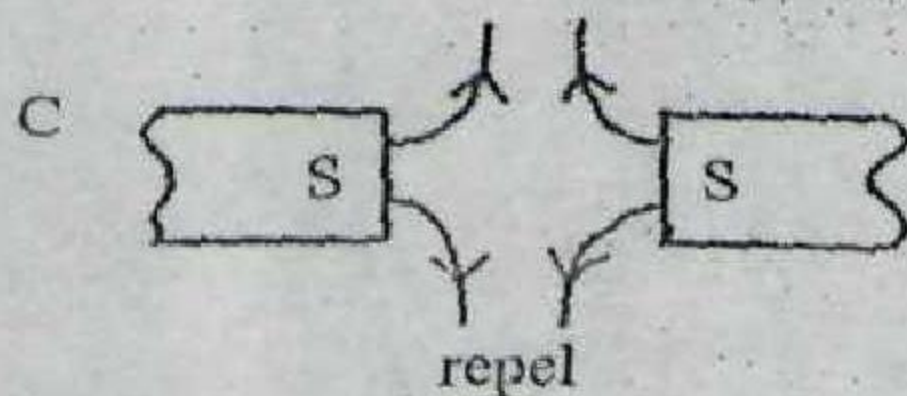
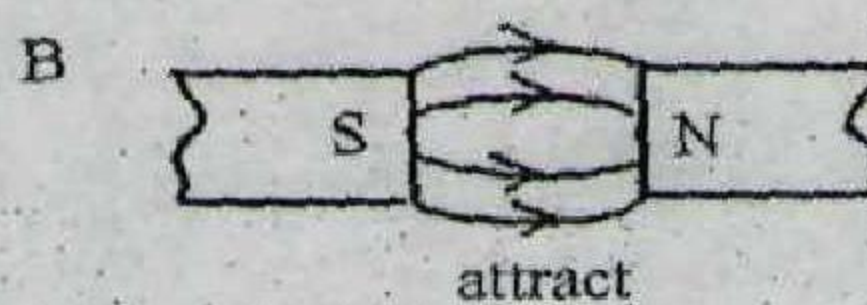
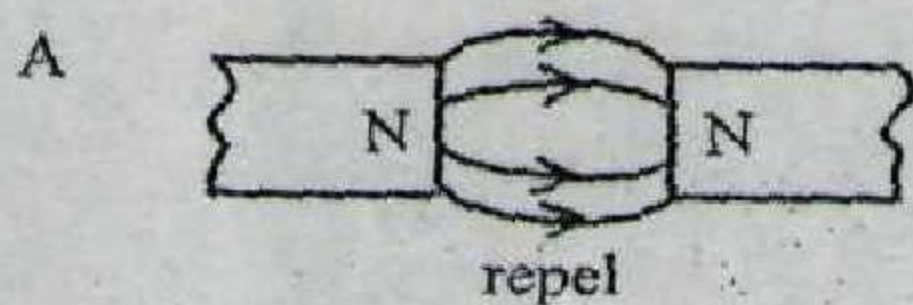
37. A householder uses a 2 000 W electric water heater on a timer. If the timer switches on at 6 a.m. and off at 10 a.m., what will be the cost of operating the heater each day if 1 kWh of electricity costs \$0.20?

- A \$0.08
- B \$0.16
- C \$1.60
- D \$16.00

38. In which circuit does the resistor R have a resistance of $12\ \Omega$?



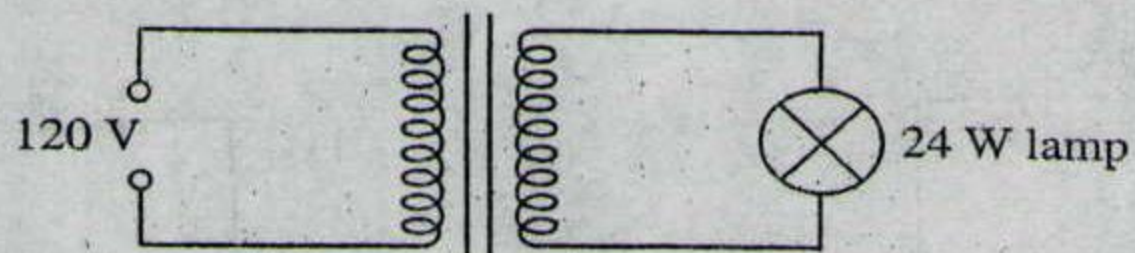
39. The diagrams show two magnetic poles near to one another. Which diagram shows the correct field shape, direction and interaction between the magnets?



40. Which of the following materials is the best choice for the core of a transformer?

- A laminated iron
- B laminated steel
- C solid iron
- D solid steel

41. The diagram shows an ideal transformer used to operate a 24 W lamp from a 120 V a.c. supply.



The transformer has 1 000 turns on the primary coil and 100 turns on the secondary coil. What will be the power input to transformer?

- A 10 W
- B 24 W
- C 120 W
- D 288 W

42. In which of the following would you find a commutator?

- A a.c. generator
- B d.c. motor
- C electric heater
- D transformer

43. Which device uses the principle of electromagnetic induction?

- A ammeter
- B electric motor
- C generator
- D voltmeter

44. The diagram shows a beam of cathode rays being deflected by two plates.



Which row shows the charges on the plates?

	plate 1	plate 2
A	positive	negative
B	negative	positive
C	no charge	no charge
D	negative	no charge

45. The chart gives the variation of activity with time of a radioactivity isotope.

activity (counts/minutes)	128	64	32	16	8
time (minutes)	0	10	20	40	80

What is the half-life of the isotope?

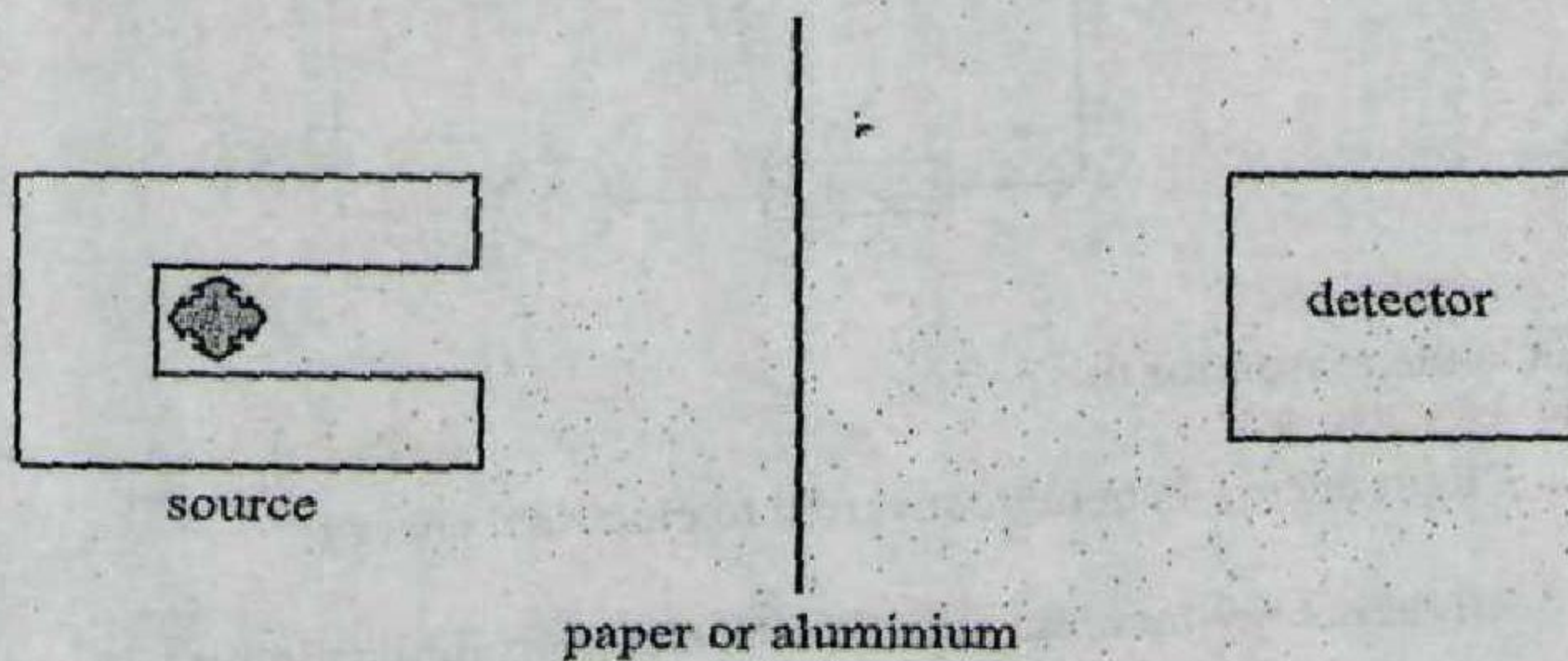
- A 5 minutes
B 10 minutes
C 20 minutes
D 40 minutes
46. An isotope of uranium can be represented by ${}_{92}^{235}\text{U}$. Which row lists the number of electrons, neutrons and protons from a neutral atom of the uranium isotope?

	electrons	neutrons	protons
A	92	143	235
B	92	92	143
C	92	143	92
D	143	92	92

47. The nuclide ${}_{84}^{216}\text{Po}$ decays to ${}_{82}^{212}\text{Pb}$. How does this occur?

- A emission of α -particle.
B emission of a β -particle.
C emission of a neutron.
D emission of a proton.

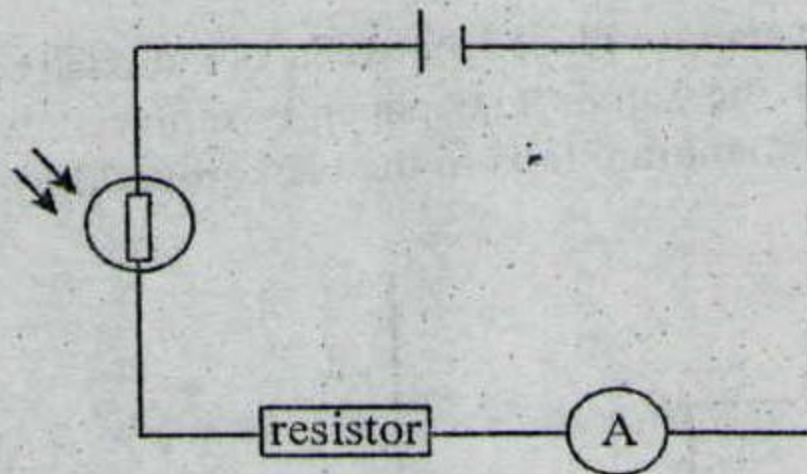
48. When a sheet of paper is placed between a radioactive source and a detector the count rate remains the same. The paper is replaced with a 3 mm thick sheet of aluminium and the count rate falls to the background level.



What type of radiation is the radioactive source emitting?

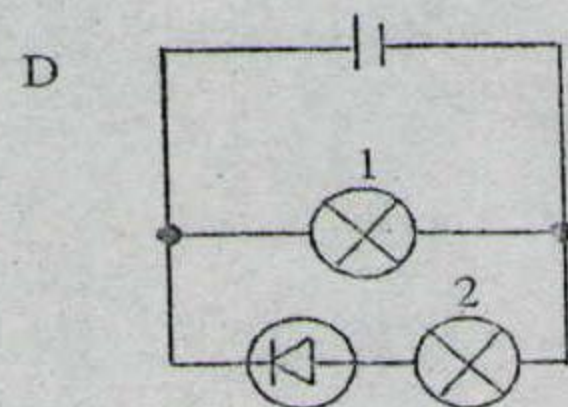
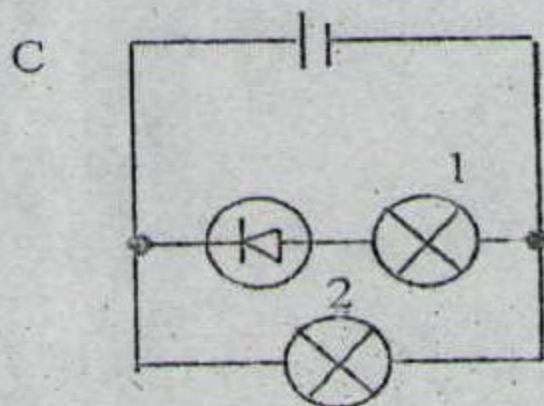
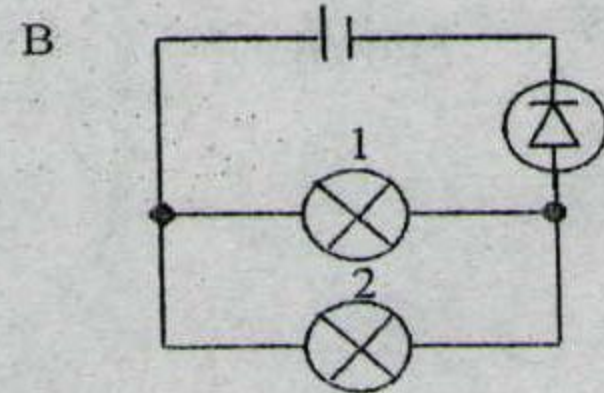
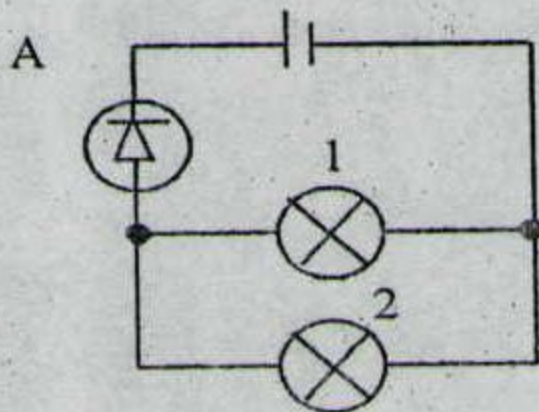
- A α -particles and β -particles only
- B α -particles only
- C β -particles
- D γ -rays only

49. When the light-dependent resistor in the circuit is exposed to increased light intensity, the ammeter records a higher reading.



What is the reason for this?

- A light energy is being converted to electrical energy
 - B light energy increases the flow of electrons in the circuit
 - C light has caused a decrease in the light-dependent resistor
 - D light has caused an increase in the light-dependent resistor
50. In which circuit will only **lamp 1** be lit?



3117/2

BGCSE

School Number	Candidate Number
Surname and Initials	

PHYSICS

PAPER 2 3117/2

Thursday **28 May 2009** 1.20 – 2.50 P.M.

Additional materials:
paper for rough work

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number, candidate number, surname and initials in the spaces provided above.

Answer **ALL** the questions on this paper.

Read each question carefully and make sure you know what you have been asked to do before starting your answer.

Show **ALL** your working when answering numerical questions. Lines are provided on the question paper for your answers. You should write your answers on these lines only.

The mark for each question or part question is given in brackets [].

This question paper consists of 13 printed pages and 3 blank pages.

2. This question is about electromagnetism.

Fig. 2.1 shows a diagram of a car's starter motor circuit and a current carrying solenoid.

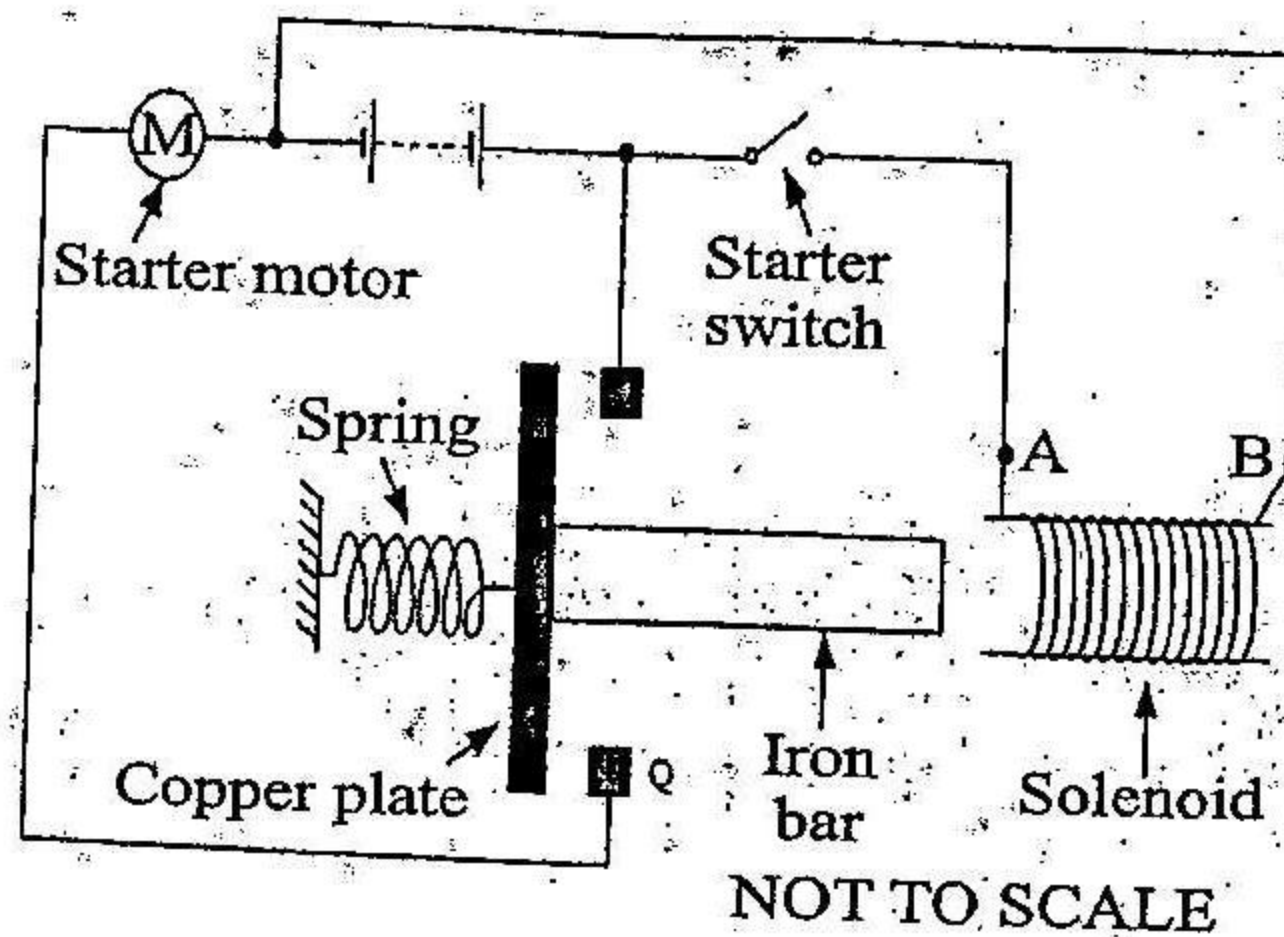


Fig. 2.1

- (a) Use arrows to show the direction of the current at A, once the starter switch is closed. [1]
- (b) (i) On the diagram, label the magnetic polarities of the solenoid. [1]
(ii) State the rule you used to determine the polarities of the solenoid. [2]
- (c) State what happens to the iron bar when the starter switch is closed. [1]
- (d) Explain your answer to part (c). [2]
- (e) State the function of the copper plate. [1]
- (f) Briefly explain why the plate is made of copper. [1]

- (g) A mechanic accidentally reverses the connections at points A and B. Describe and explain how this will affect, if at all, the action of the circuit.

[2]

Total marks [10]

3. This question is about waves. Fig. 3.1 shows a vibrating source, S, generating ripples in a shallow trough of water at a rate of 5 per second. The wavelength of the waves is 1.5 cm.

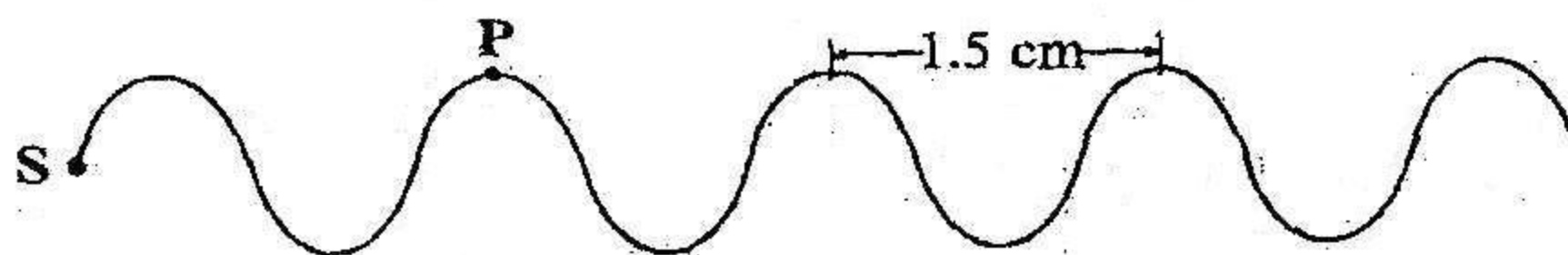


Fig. 3.1

- (a) Describe the motion of the source S and state its frequency.
- _____
- _____ [2]
- (b) With reference to the diagram above, write one statement about the frequency of a particle, P, of the water.
- _____
- _____ [2]
- (c) Calculate the velocity of the wave.
Use the equation: $\text{velocity} = \text{frequency} \times \text{wavelength}$.
- _____ [2]
- (d) Name the type of wave shown in the diagram.
- _____ [1]
- (e) State the relationship between the direction of vibration of the water molecules and the direction of travel of the wave.
- _____ [1]
- (f) Give TWO examples of this type of wave, other than a water wave.
- _____
- _____ [2]

Total marks [10]

[Turn over]

4. (a) This question is about the behaviour of molecules.

Fig. 4.1 shows a glass with concentrated orange drink poured into it. Water is added carefully. The water floats on the orange drink.

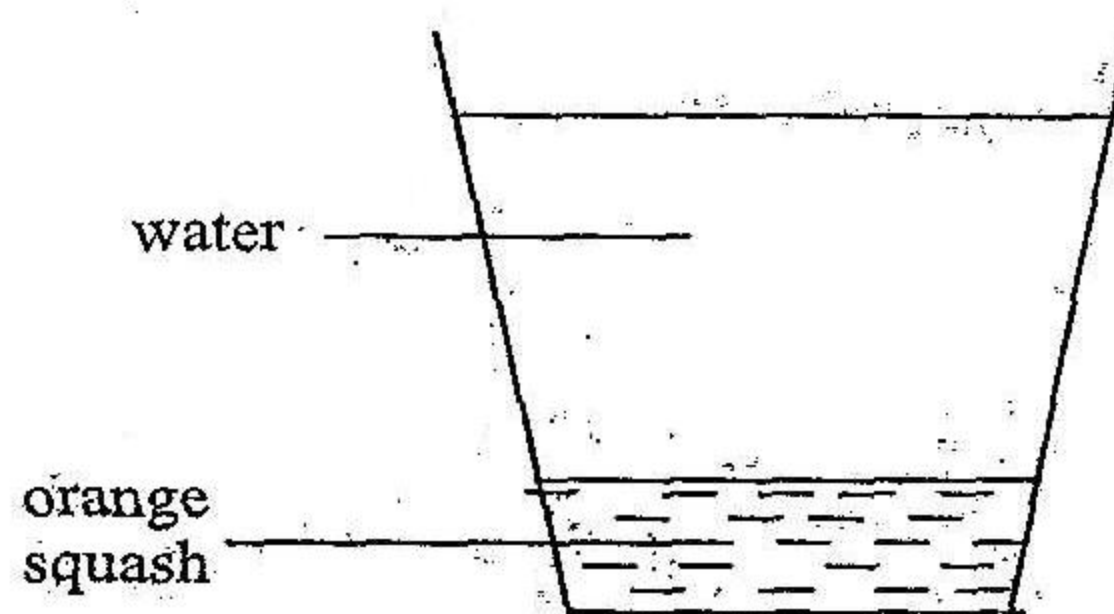


Fig. 4.1

- (i) Compare the density of water with the density of the orange drink.

_____ [1]

- (ii) The drink is left untouched at room temperature. After a day, the orange colour has spread into the water.

Suggest a reason for this, using the word molecules in your answer.

_____ [2]

- (iii) Another drink is prepared the same way. It is put into the refrigerator. After the same amount of time, the orange colour has not spread as far.

Suggest a reason for this, using the word molecules in your answer.

_____ [2]

- (b) Fig. 4.2 shows clothes hung on a line to dry.

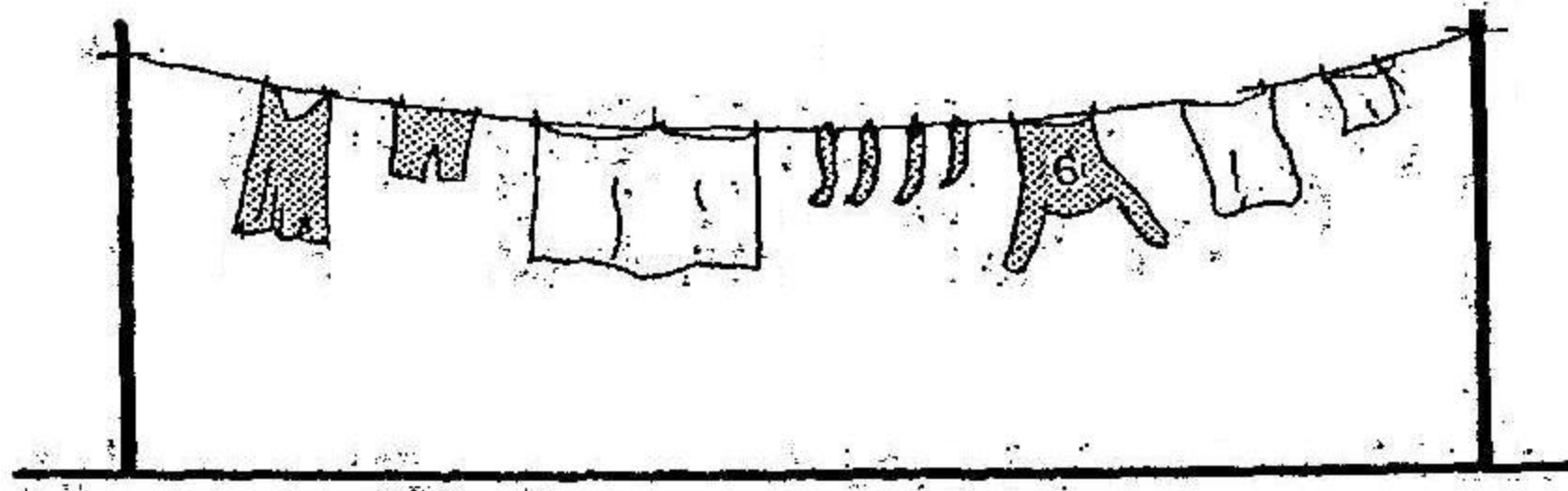


Fig. 4.2

- (i) Briefly explain why clothes dry more quickly when it is windy.

_____ [1]

- (ii) List **TWO** other factors that would make clothes dry more quickly.

_____ [2]

- (iii) Explain why white clothes take longer to dry than dark clothes.

_____ [2]

Total marks [10]

5. A train travels from rest along a straight track. The graph Fig. 5.1 shows how the train's velocity changes with time.

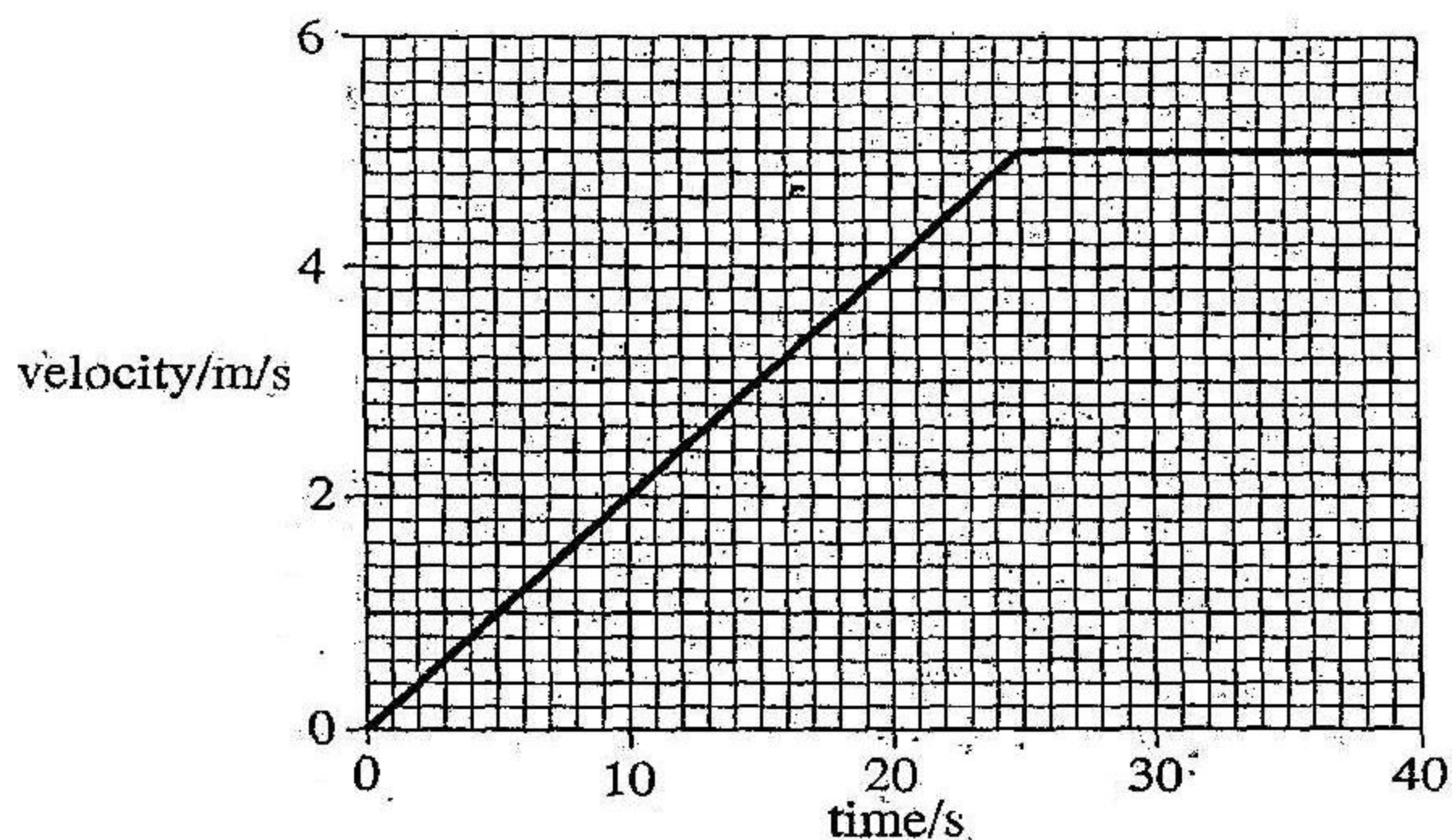


Fig. 5.1

- (a) (i) State how the distance travelled can be determined from the velocity-time graph.

[2]

- (ii) Calculate the distance travelled by the train in the first 15 s.

[2]

- (b) The mass of the train is 120 000 kg.

- (i) Calculate the acceleration of the train at 10 s.

[2]

- (ii) Calculate the unbalanced force on the train at 10 s.

[2]

- (c) Calculate the momentum of the train at 30 s.

[2]

Total marks [10]

6. This question is about static electricity.

Figure 6.1(a) shows a strip of polythene cut from a plastic shopping bag hung over the edge of a plastic ruler. When the ends of the strip are rubbed individually between the fingers and let go, they fly apart, as shown in Fig. 6.1(b). A rod of Perspex is charged positively by being rubbed on a duster. When this rod is placed between the ends of the polythene strip, they stick to it, as shown in Fig. 6.1(c).

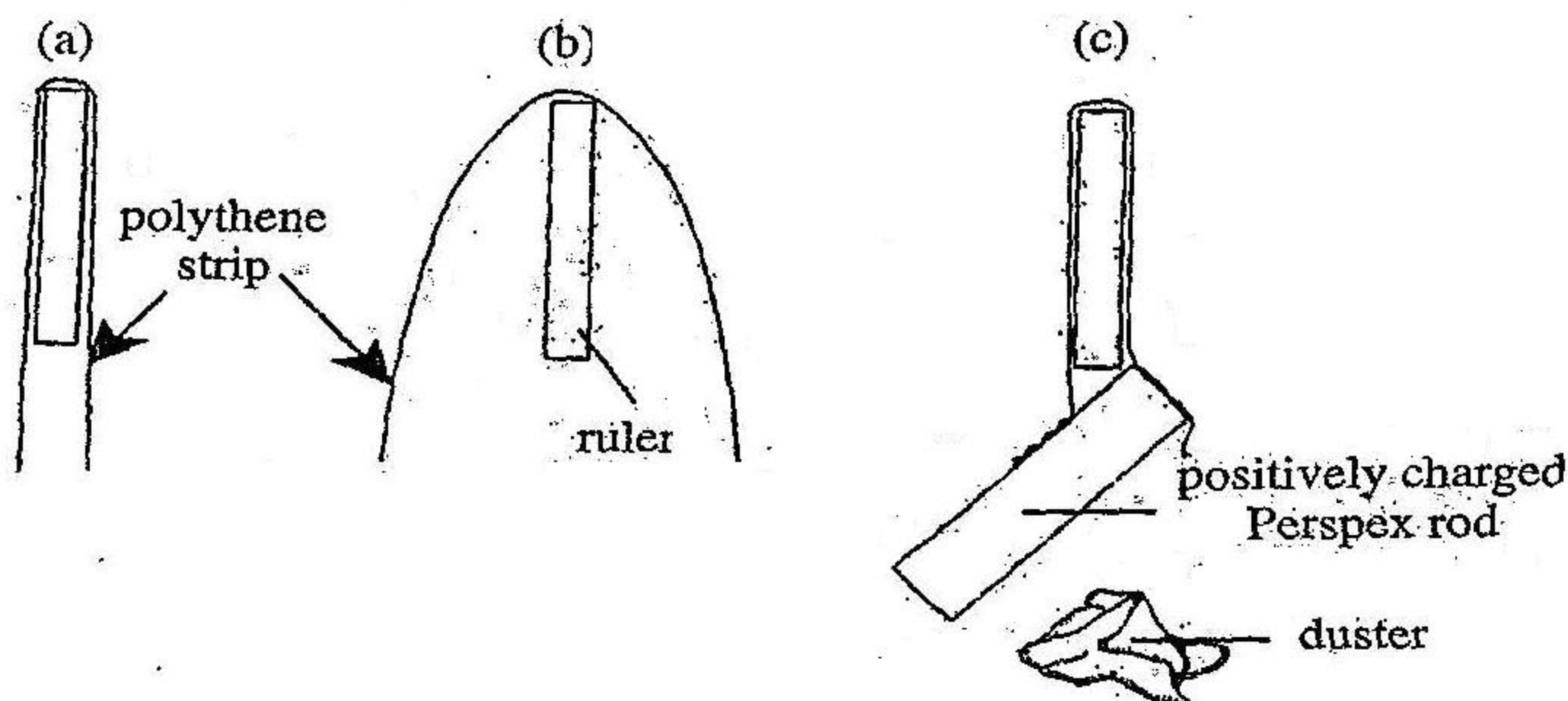


Fig. 6.1

(a) Explain

(i) why the ends of the strip fly apart in Fig. 6.1(b);

[1]

(ii) why the ends of the strip "stick" to the Perspex in Fig. 6.1(c).

[1]

(b) (i) The Perspex has become positively charged. State what has happened to the duster.

[1]

- (ii) Explain, in terms of electrons, how this happens.

[2]

- (c) Static electricity is used to remove dust from gases which go up chimneys. Fig. 6.2 shows a simple electrostatic precipitator. The potential difference between the negatively charged plates and the positively charged wire grid is 50 kV.

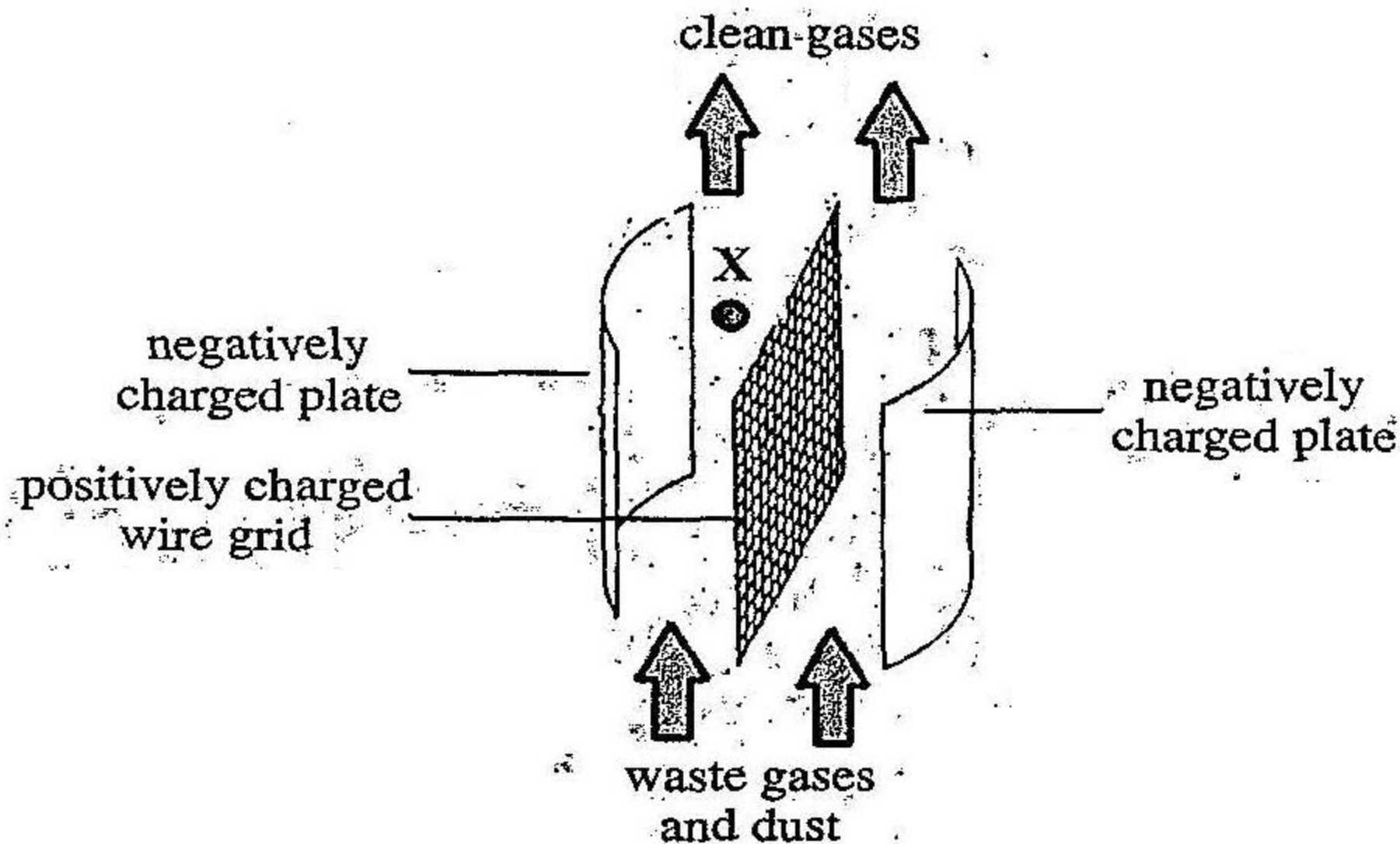


Fig. 6.2

- (i) Express 50 kV in volts.

[1]

- (ii) X is a dust particle made negative by ions which stick to it. Draw an arrow on Fig. 6.2 to show the direction of the electric force acting on X.

[1]

- (iii) Explain how the precipitator removes dust from waste gases.

[3]

Total marks [10]

7. This question is about the Cathode Ray Tube (CRT).

- (a) Fig. 7.1 shows a diagram of a CRT. One of the main features has been labelled for you. In the spaces provided, label the other five features. [4]

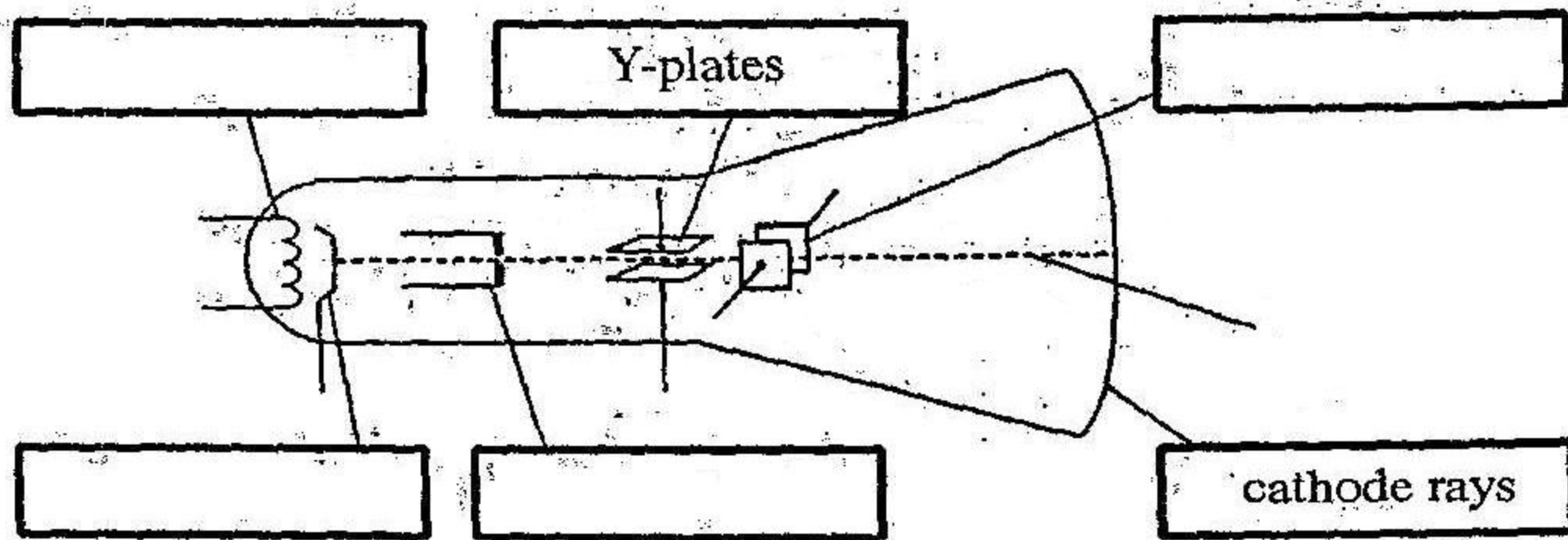


Fig. 7.1

- (b) State what occupies the rest of the space inside the Cathode Ray Tube.

_____ [1]

- (c) Briefly explain what causes the cathode to emit the cathode rays.

_____ [2]

- (d) What are cathode rays?

_____ [1]

- (e) Name the process taking place at the cathode.

_____ [1]

- (f) Give an example of a use for a cathode ray tube.

_____ [1]

Total marks [10]

8. (a) Alpha particles (α), beta (β) and gamma rays (γ) are types of nuclear radiation.

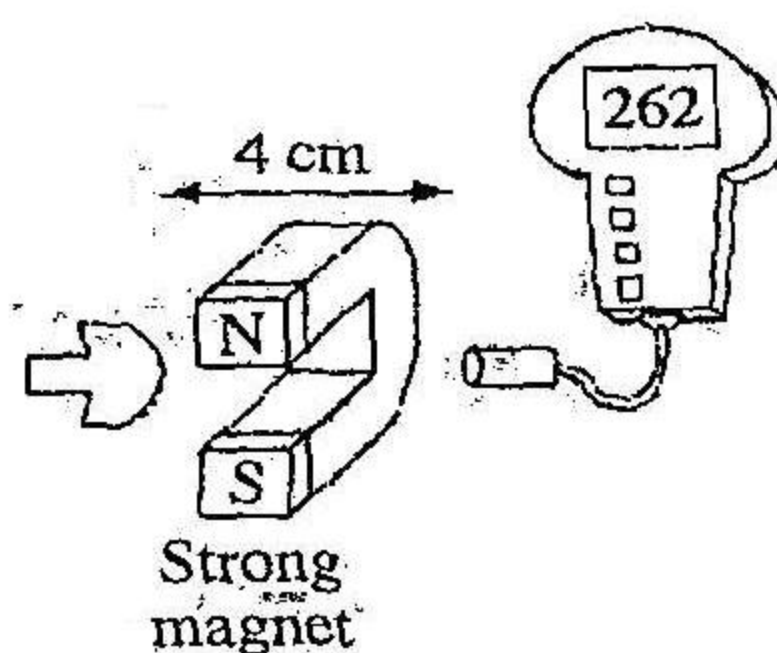
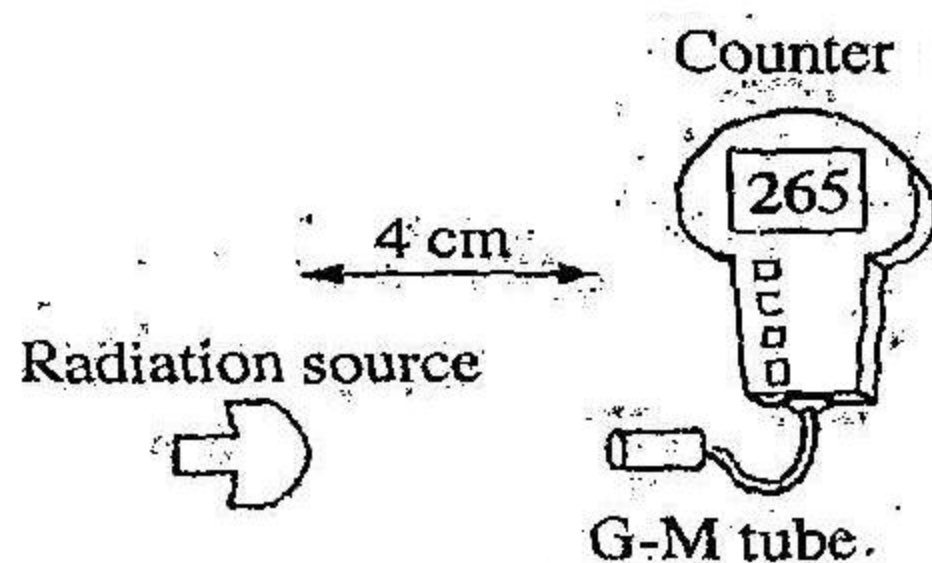
(i) State which of the three types of radiation is the most strongly ionising.

[1]

(ii) State the effect of nuclear radiation on living cells.

[1]

(b) The diagrams show a G-M tube and counter used to measure the radiation emitted from a source. Both diagrams show the reading on the counter one minute after it was switched on.



Explain why the counter readings show that the source is giving out only gamma radiation.

[2]

- (c) The box gives information about the radioactive isotope technetium-99

Type of radiation emitted: gamma

Half-life: 6 hours

Used as a medical tracer

- (i) State what is meant by the term *half-life*.

_____ [1]

- (ii) To study the blood flow in a patient's lung, a doctor injects a small quantity of a technetium-99 compound into the patient. The radiation emitted by the technetium-99 atoms is detected outside the patient's body.

Explain why a doctor would not use a radioactive isotope with a very short half-life, such as 2 seconds, as a medical tracer.

_____ [2]

- (d) A radioactive isotope of barium has a half-life of 2 minutes. The isotope of barium has an activity rate of 200 disintegration/minute.

Calculate the activity rate of the barium isotope after 6 minutes.

[3]

Total marks [10]

3117/3

BGCSE

School Number

Candidate Number

Surname and Initials

PHYSICS

PAPER 3 3117/3

Tuesday **9 JUNE 2009** 12 NOON – 1.30 P.M.

Additional materials:
Answer Booklet for Section B
Graph paper

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number, candidate number, surname and initials in the spaces provided at the top right-hand corner of this question booklet and on the answer booklet.

Answer **ALL** the questions in **Section A** in the space provided.

Answer **TWO** questions from **Section B** in the answer booklet.

Show **ALL** your working when answering numerical questions.

Answers to numerical problems should be given to a suitable number of significant figures.

The mark for each question or part-question is given in brackets [].

This question paper consists of 11 printed pages and 1 blank page.

LIST OF FORMULAE

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{pressure} = \frac{\text{normal force}}{\text{area}}$$

$$\text{pressure due to a liquid} = \text{depth} \times \text{density} \times g$$

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{average velocity} = \frac{\text{distance travelled in a given direction}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{increase in velocity}}{\text{time}}$$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{ideal gas equation}$$

$$\text{Charles' law equation}$$

$$\text{kinetic energy} = \frac{1}{2} \text{ mass} \times \text{speed}^2$$

$$\text{change in gravitational potential energy} = \text{weight} \times \text{change in height}$$

$$\text{power} = \frac{\text{energy}}{\text{time}}$$

$$\text{efficiency} = \frac{\text{work output}}{\text{work input}}$$

$$\text{efficiency} = \frac{\text{power output}}{\text{power input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{energy} = \text{mass} \times \text{specific heat capacity} \times \text{temperature change}$$

$$\text{charge} = \text{current} \times \text{time}$$

$$\text{potential difference} = \frac{\text{work done}}{\text{charge moved}}$$

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

$$\text{effective resistance of resistors in series}$$

$$\text{effective resistance of resistors in parallel}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{refractive index of a medium}$$

$$\text{magnification} = \frac{\text{image distance (v)}}{\text{object distance (u)}}$$

$$\text{weight} = mg$$

$$F = ma$$

$$p = \frac{F}{A}$$

$$p = hDg$$

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

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

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

$$D = \frac{m}{V}$$

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\text{kinetic energy} = \frac{1}{2} mv^2$$

$$v = f\lambda$$

$$W = mc\Delta\theta$$

$$Q = It$$

$$V = \frac{W}{Q}$$

$$R = \frac{V}{I}$$

$$R = R_1 + R_2$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$P = VI$$

$$n = \frac{\sin i}{\sin r} = \frac{\text{real depth}}{\text{apparent depth}}$$

$$m = \frac{v}{u}$$

3. This question is about density and the transfer of internal energy.

Fig. 3.1 is a graph showing how the volume of a fixed mass of water varies as the temperature increases from -2°C to 10°C .

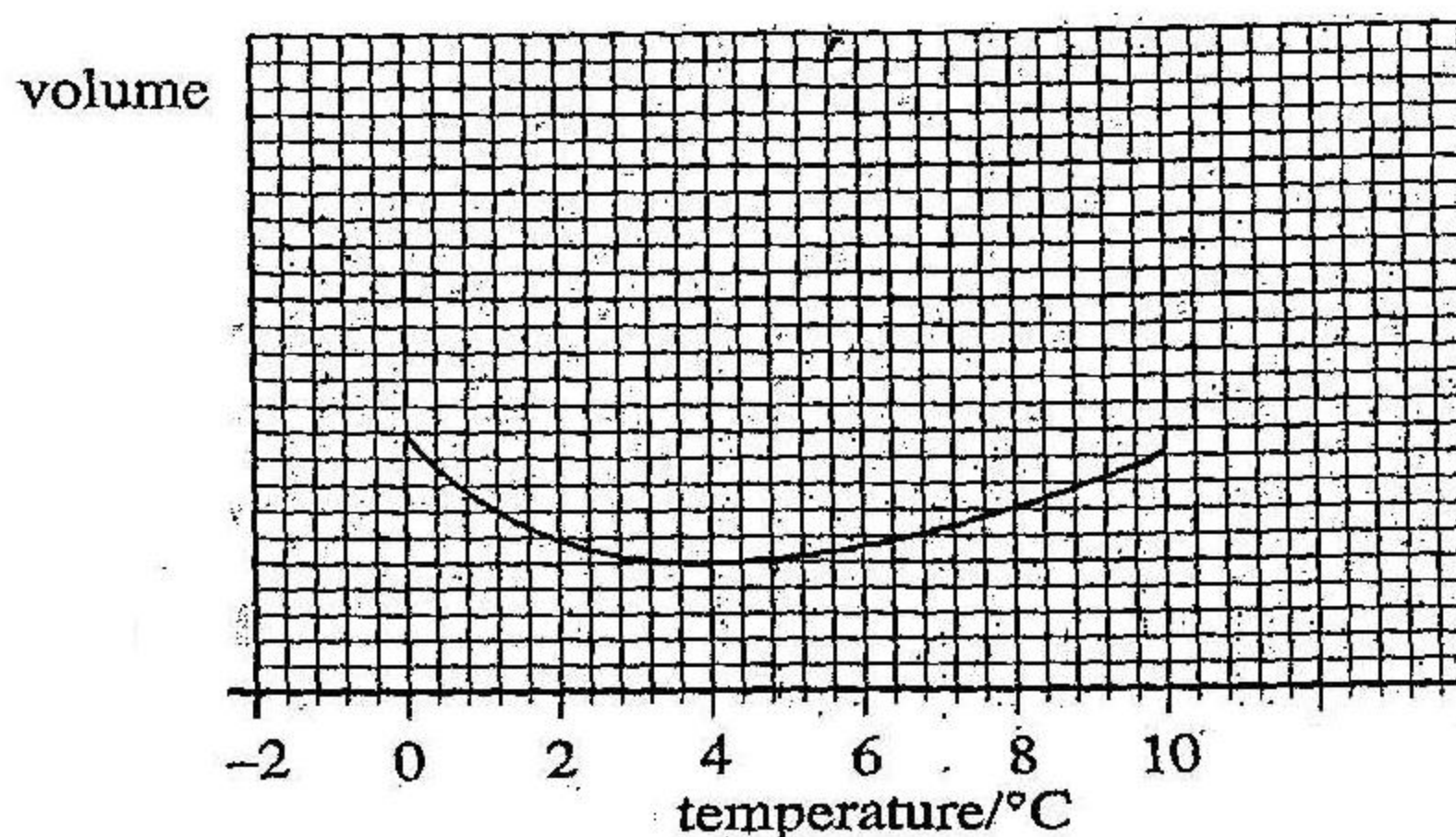


Fig. 3.1

- (a) Describe how the volume of the water varies
- (i) at 0°C ,

 - (ii) between 0°C and 4°C ,

 - (iii) between 4°C and 10°C .
_____ [3]
- (b) Use the terms maximum and minimum to describe the volume and density of water at 4°C .
- (i) volume _____
 - (ii) density _____ [2]
- (c) State the term used to describe this property of water.

_____ [1]

- (d) Fig. 3.2 shows a section through a small pond.

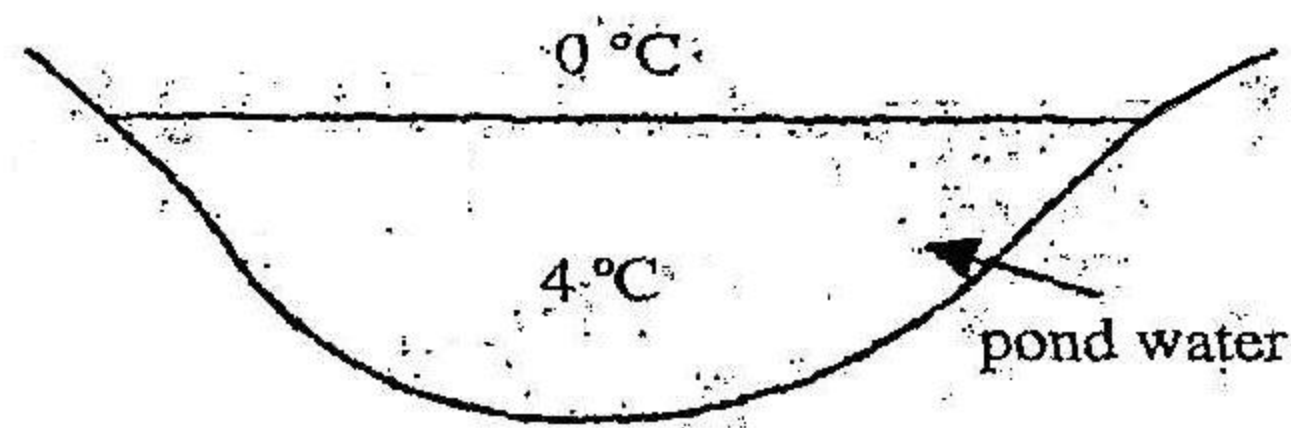


Fig. 3.2

- (i) Name the main method of internal energy transfer which will take place from the water at the bottom of the pond to the water at the surface.

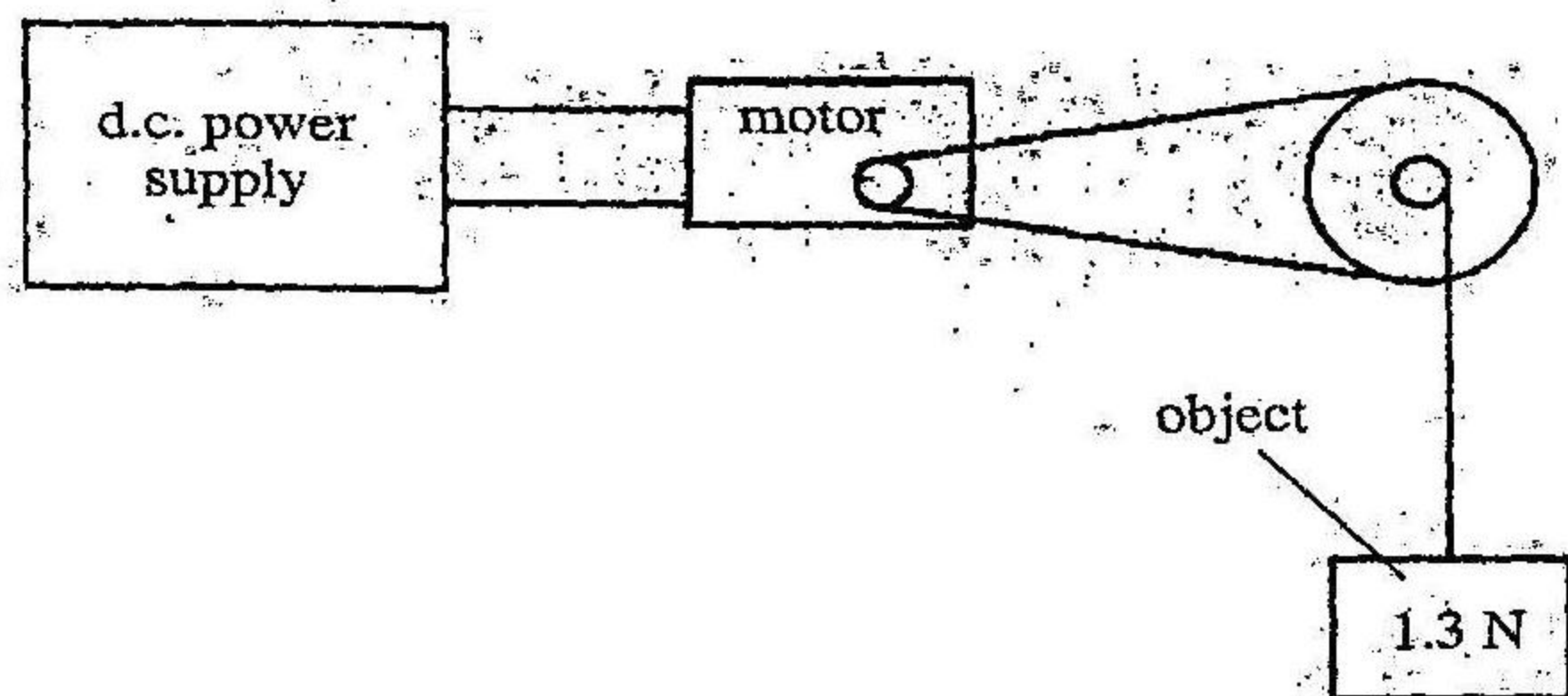
_____ [1]

- (ii) Describe and explain what happens when the temperature of the water at the bottom of the pond drops to 4°C .

_____ [3]

Total marks [10]

4. The diagram shows a small electric motor being used to lift an object of weight 1.3 N. The power input to the motor from the supply is 0.8 W.



- (a) The gravitational potential energy of the object increases by 1.08 J in 4 s.
- (i) Calculate the rate at which the weight gains gravitational potential energy.
(Use $g = 10 \text{ N/kg}$).
- [2]
- (ii) Calculate the height through which the object is lifted in 4 s. State the equation used in your calculation.
- [3]
- (iii) Calculate the efficiency of the motor.

[2]

- (b) The raised object is held in place whilst the power supply is disconnected and a small lamp is connected across the output to the motor. The object is released and the lamp lights.

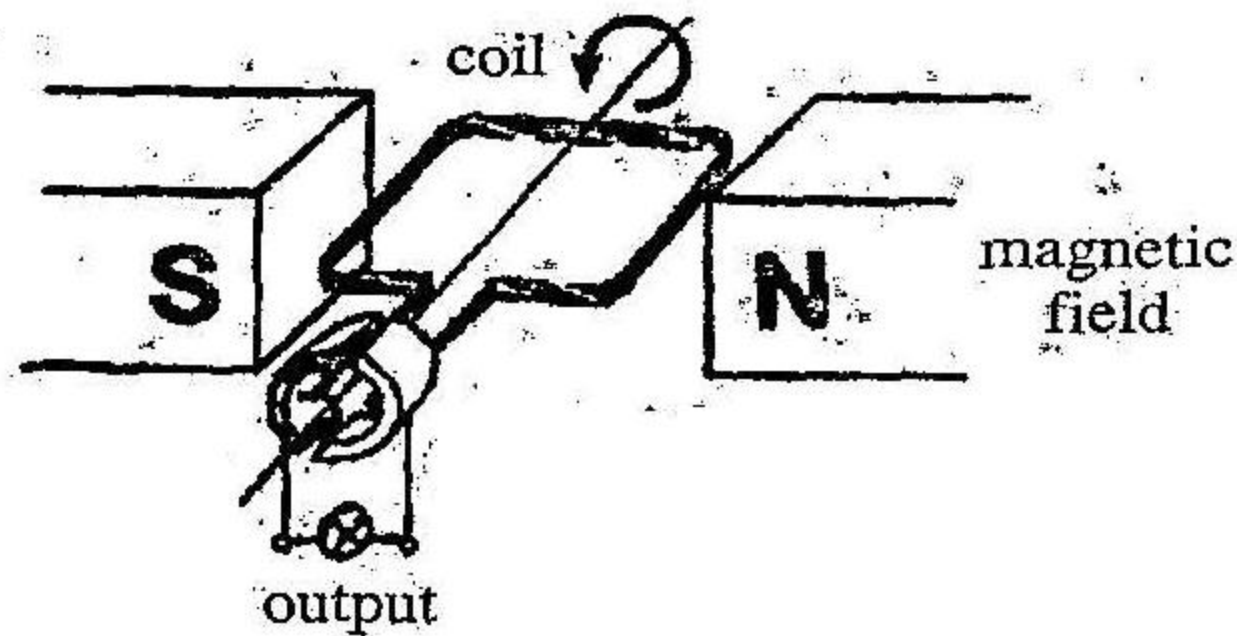


Fig. 4.2.

- (i) With reference to Fig. 4.2, explain why the lamp lights.

[2]

- (ii) Explain why the brightness of the lamp increases as the weight falls.

[1]

Total marks [10]

SECTION B

Answer any TWO questions from this Section.

5. Fig. 5.1 shows a transformer which is used to change 120 V mains voltage to light a 12 V lamp.

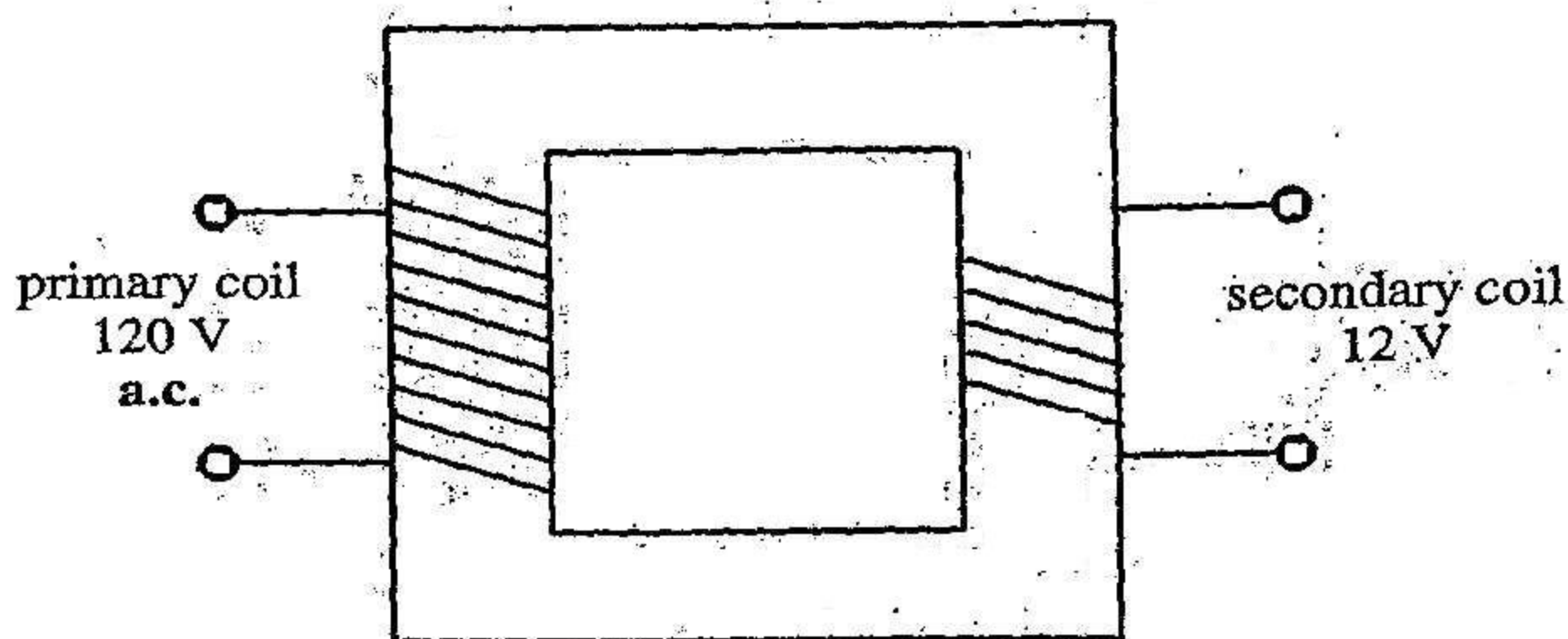


Figure 5.1

- (a) (i) State what an alternating current (a.c.) is. [2]
- (ii) Calculate the ratio of turns for the transformer. [2]
- (b) (i) Describe in detail, how a transformer works. [4]
- (ii) Explain why transformers are near 100% efficient. [1]
- (c) In investigating a mystery electrical component X, the current and voltage values shown below were obtained.

Current/A	0	0.60	1.02	1.75	2.30	2.90	3.12	3.20	3.35
Voltage/V	0	3.6	6.5	11.0	14.5	19.5	22.5	25.0	29.5

- (i) Plot a graph of current against voltage. [6]
- (ii) One theory about component X is that up to a certain current its resistance remains constant. Explain how this investigation supports this theory. [2]
- (iii) State the current beyond which its resistance changes. [1]
- (iv) Calculate the value of the constant resistance. [2]

Total marks [20]

6. This question is about refraction of light.

Fig. 6.1 shows a flashlight held under water in such a way that a ray of light is produced which can strike the surface of the water at different angles, i .

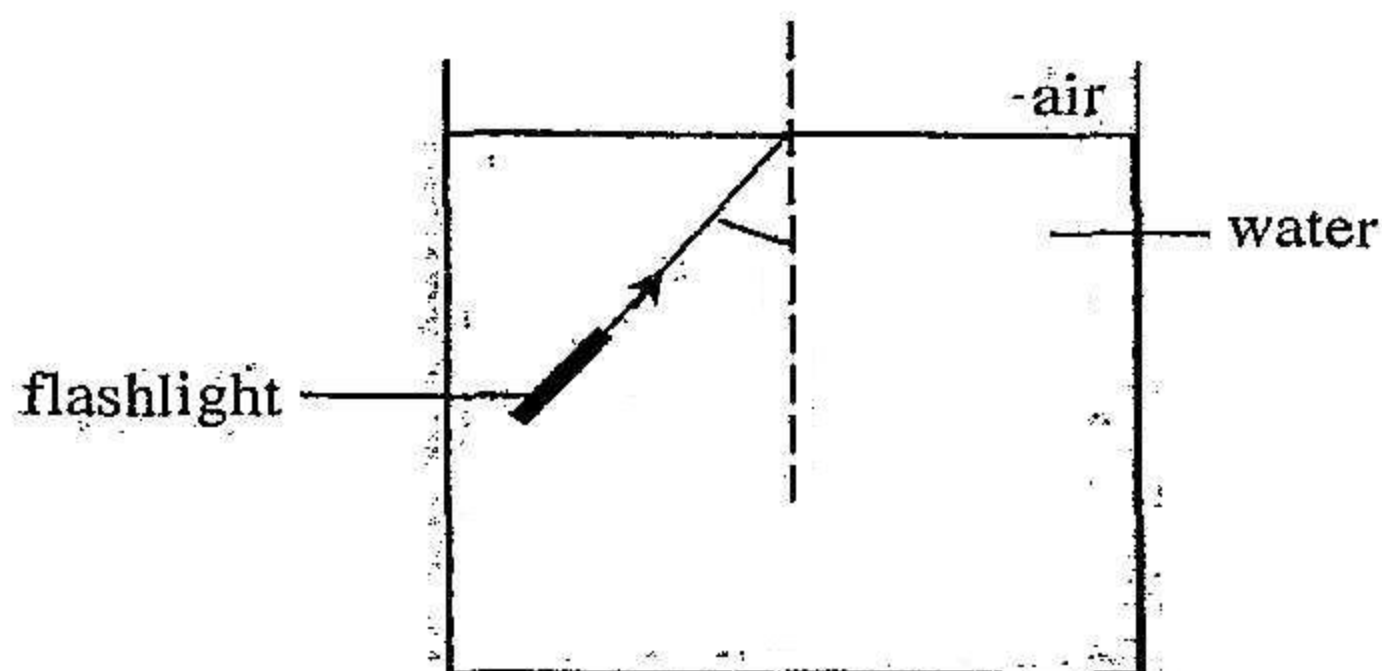


Figure 6.1

(a) The critical angle for water is about 49° .

(i) Draw sketches when i is about

1 20°

(ii) 2 60° [4]

Name the phenomenon taking place in sketch 2. [1]

(b) In an experiment to determine the refractive index of water, a black line is painted on the bottom of a tall glass container which is then partially filled with water.

On looking vertically down into the water the black line appears to be closer than it really is. Explain, with the aid of a diagram, why this is so. [5]

(c) The following results were obtained in such an experiment.

read depth/cm	81.1	12.0	16.0	20.0
apparent depth/cm	5.9	9.1	12.0	15.1

Plot a graph of real depth (y -axis) against apparant depth (x -axis). [6]

(d) From the graph, determine the refractive index of water. [4]

Total marks [20]

7. This question is about isotopes and radioactive decay.

(a) An atom of radium can be represented by $^{226}_{88}\text{Ra}$

(i) State the information about the nucleus of the atom given by the numbers 226 and 88. [2]

(ii) The radium is thought to be radioactive, emitting only alpha particles and gamma rays. Describe, using a labelled diagram, how the truth of this statement could be checked. [5]

(iii) State the composition of the resulting nucleus if this isotope of radium decayed by emitting an alpha particle. [2]

(b) The count rate from a radioactive isotope is measured the same time every day. The results are as shown.

time/days	0	1	2	3	4	5	6
count rate/minute	12 000	7 650	5 000	3 300	2 150	1 400	900

Plot a graph of count rate (y-axis) against time (x-axis). [6]

(c) (i) From the graph, measure two values for the half-life of the isotope. [3]

(ii) From the graph, find the count rate after 3.5 days. [2]

Total marks [20]