Centre Number	Index Number	Name	Class

WEST SPRING SECONDARY SCHOOL

Thirst for Knowledge

PRELIMINARY EXAMINATION 2007

5052 / 02

PHYSICS
PAPER 2 THEORY

DATE: 11 / 09/ 2007
DURATION: 1 Hour 45 Minutes

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number, name and class on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
Write your answers to section A and to questions 9 and 10 in the **spaces provided** on the Question paper.
Write your answers to **Question 11 on the lined pages** and, if necessary, continue on the separate answer paper provided.
Candidates are reminded that **all** quantitative answers should include appropriate units.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of physics than for correct answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's use	
A	
B	
Total	

SETTER (S): MR. PRAKASH

This Document consists of **16** printed pages and **2** lined pages. **[Turn Over]**

Section A

Answer **all** the questions in this section.

1 Fig. 1.1 shows the speed-time graph for a small balloon initially at rest, then falling vertically through the air and then attaining constant speed.

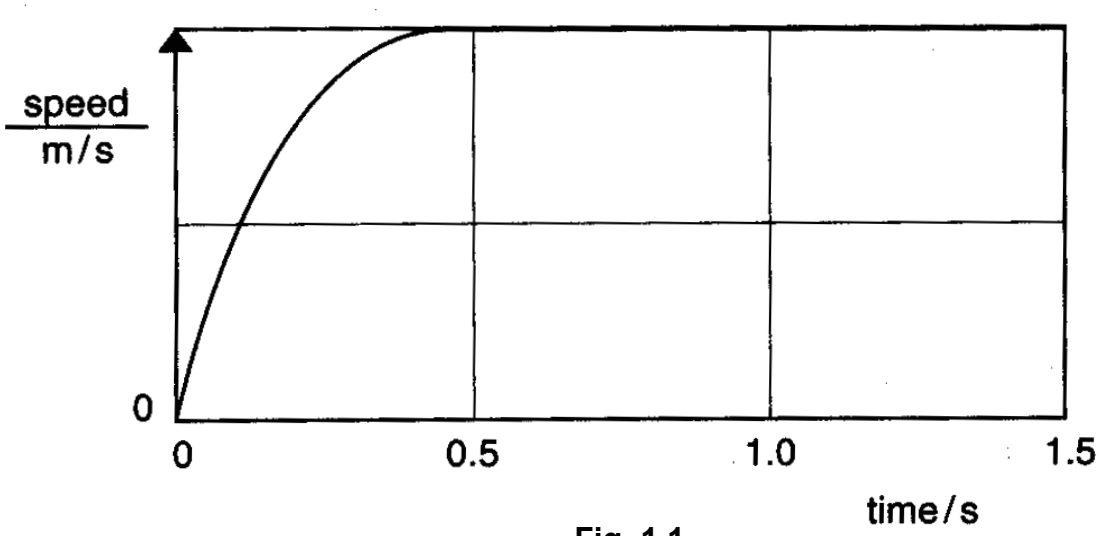

Fig. 1.1

(a)(i) Use Fig. 1.1 to determine the time interval over which the balloon is accelerating.

…….. [1]

(ii) Is the acceleration constant? Explain your answer.

……

……[2]

(b) Explain, using the forces acting, the motion of the balloon for the first second after release.

……

……

……

……[2]

(c) The mass of the balloon is 60 g. The gravitational field strength is 10 N/kg.

(i) Calculate the weight of the balloon,

weight =…… [1]

(ii) State the value of the air resistance on the balloon 1.0 s after release. Explain your answer.

…..……..……

……..……[2]

2 A cyclist, together with his bicycle, has a total mass of 90 kg and is travelling with a constant speed of 15 m/s on a flat road at A, as shown in Fig. 2.1. He then goes down a small slope to B so descending 4.0 m.

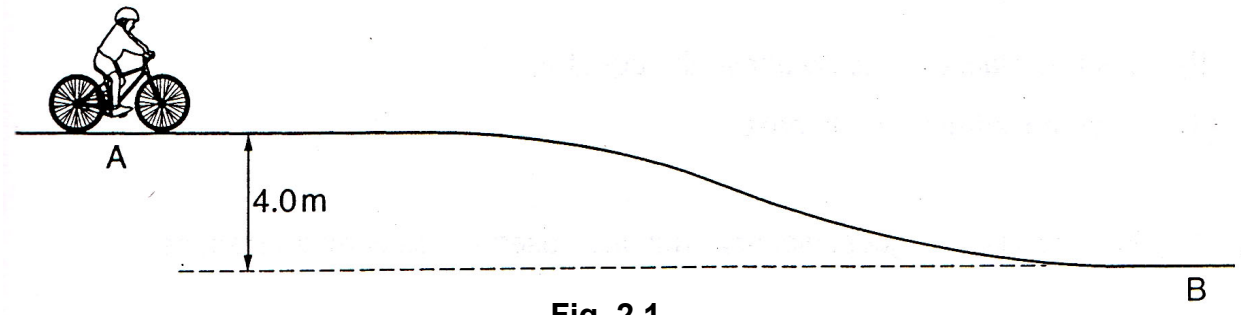

Fig. 2.1

Calculate

(a) the kinetic energy at A,

kinetic energy =..... [1]

(b) the loss of potential energy between A and B,

loss of potential energy =..... [1]

(c) the speed at B, assuming that all the lost potential energy is transformed into kinetic energy of the cyclist and bicycle.

speed =..... [3]

3 Sebastian holds the loose end of a long rope which is fixed to a post. He moves it up and down at a rate of 20 times every 5 seconds. Each time he moves the rope 15 cm up and 15 cm down from its original rest position. Fig. 3.1 shows the wave moving along the rope.

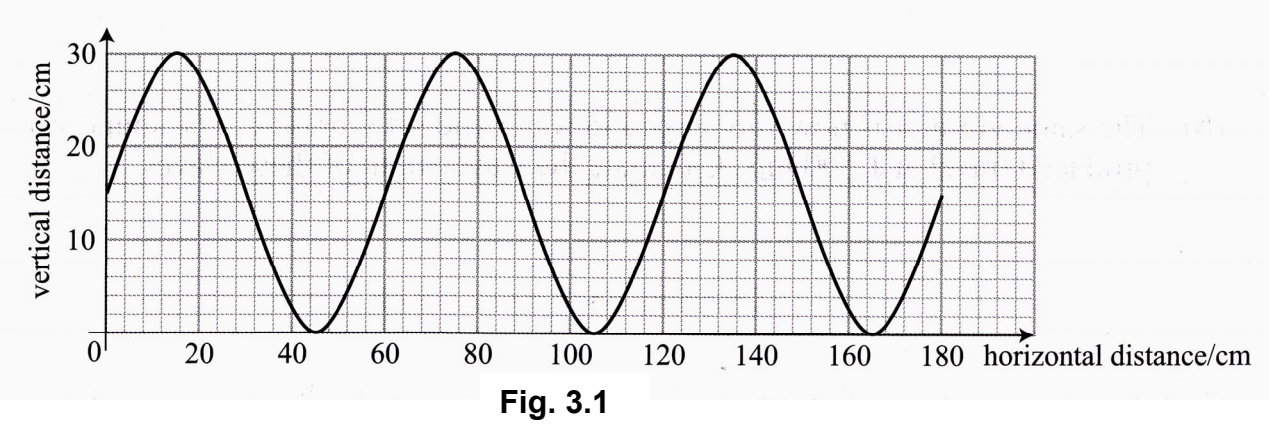

Fig. 3.1

(a) Why is the wave that travels along the rope called *transverse wave*?

……

……[1]

(b) State two other examples of transverse wave.

……[1]

(c) State the value of the amplitude of the wave.

amplitude =…… [1]

(d) Calculate the frequency of the wave.

frequency =…… [1]

(e) State the value of the wavelength of the wave.

wavelength =…… [1]

(f) Calculate the speed of the wave.

Speed =…… [1]

4 Fig. 4.1 shows the virtual image I formed by a converging lens L.

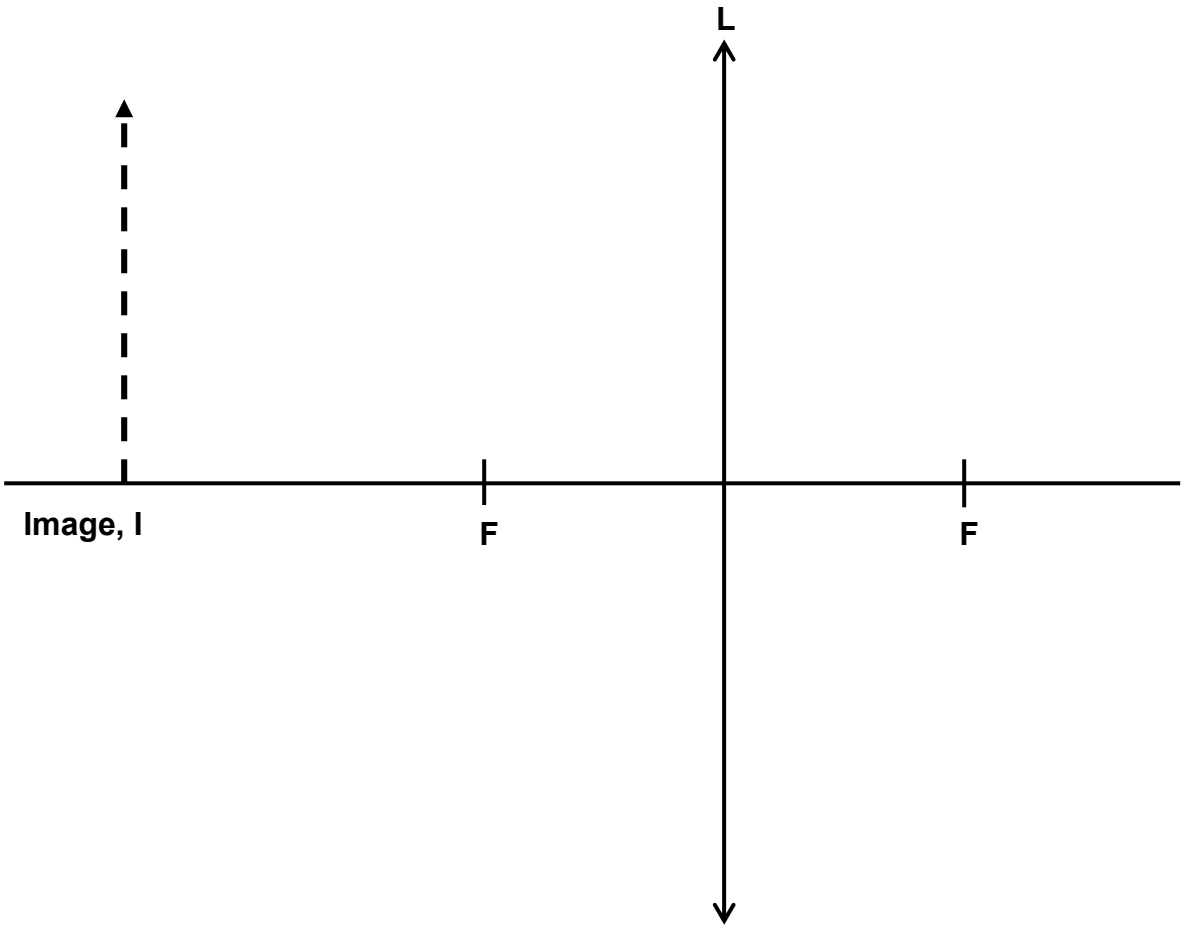

Fig. 4.1

(a) By means of a ray diagram, mark and label on Fig. 4.1 the position of the object, O. [3]

(b) What happens to the height of the image if the distance of the object from the lens is decreased?

……[1]

(c) Define the term *focal length*.

……

…… [1]

(d) Name three characteristics of the image formed if the distance of the object from the lens is equal to 1.7 times the focal length of the lens.

…… [2]

5 An electrically positively charged sphere C is brought near a small uncharged conducting sphere S suspended as shown in Fig. 5.1.

S is first attracted towards C until it touches the surface of C and then repelled to the position shown in Fig. 5.2.

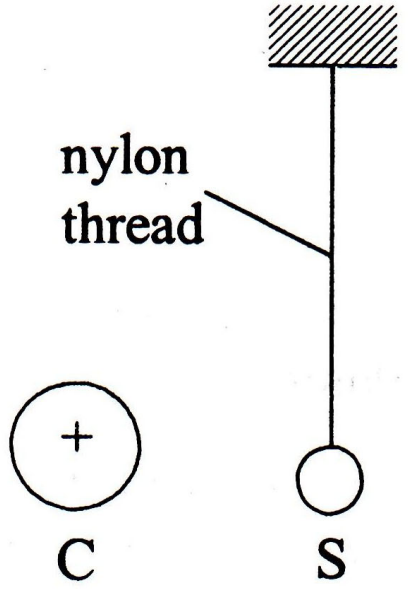

Fig. 5.1

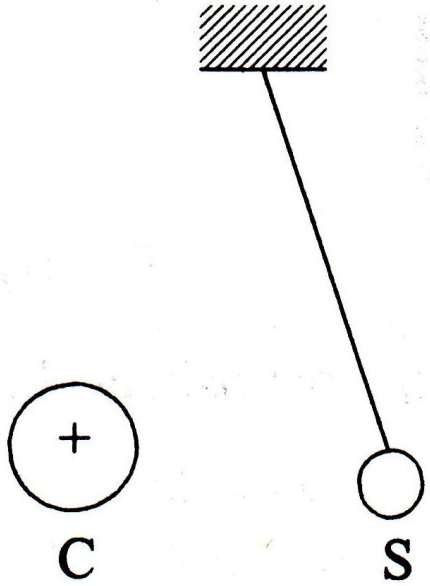

Fig. 5.2

(a) On Fig. 5.1 draw the charges induced on sphere S. [1]

(b) Explain carefully why S is first attracted towards C.

……

……

……[2]

(c) Explain why S is repelled after touching the surface of C.

……

……

……[2]

6 Fig. 6.1 shows a schematic diagram of the lighting circuit for street lamps. All 60 lamps are connected in parallel to a 240 V a.c. supply. The resistance of each lamp is 50.0 Ω. The wires connecting the lamps have negligible resistance.

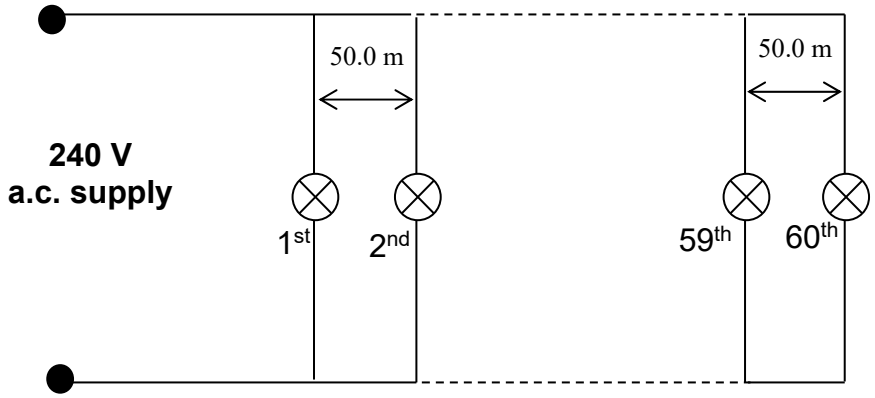

Fig. 6.1

(a) Calculate the effective resistance of the 60 lamps.

effective resistance =..... [2]

(b) Calculate the current flowing through one lamp. State the formula you use.

current =..... [2]

(c) Calculate the total current flowing out from the power source.

total current =..... [1]

(d) Calculate the power dissipated by one lamp. State the formula you use.

power =..... [2]

7 A potential divider circuit is designed with a thermistor and a fixed resistor as shown in Fig. 7.1. The thermistor has a resistance of 4 kΩ and 6 kΩ when the temperature of the surrounding is 20 °C and 0 °C respectively. This thermistor has resistance that varies linearly with temperature. The alarm sounds when the output voltage (V_{out}) is 1.0 V or less.

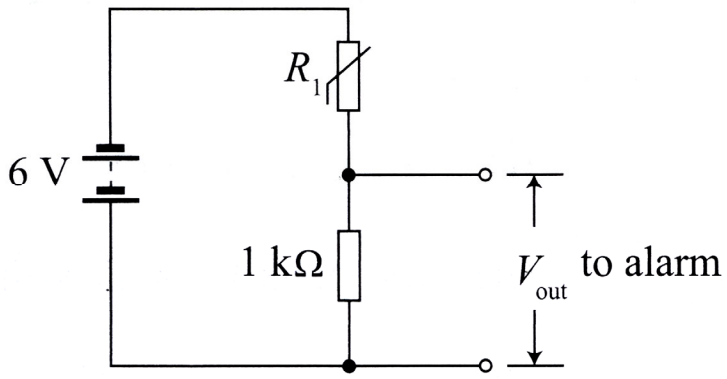

Fig. 7.1

(a) Will the alarm sound when the temperature is at 20 °C? Justify your answer by showing clearly the proper calculations.

……...…[3]

(b) Calculate the resistance of the thermistor at which the alarm is activated.

resistance =…… [2]

(c) Write down the temperature at which the alarm will be activated. Explain your conclusion.

……..……..……..……..…

……....…….……..…….. [2]

8 **(a)** A student activated a Geiger Muller (GM) tube in a classroom. It was observed that the counter on the GM tube gave a reading even though there was no known source of radioactive emission. The reading also changed from time to time.

Explain his observations.

……

……

…… [2]

(b) Uranium-234 (^{234}U) is a radioactive element. Fig. 8.1 shows the number of protons and neutrons in the nuclei of the elements formed when Uranium-234 decays.

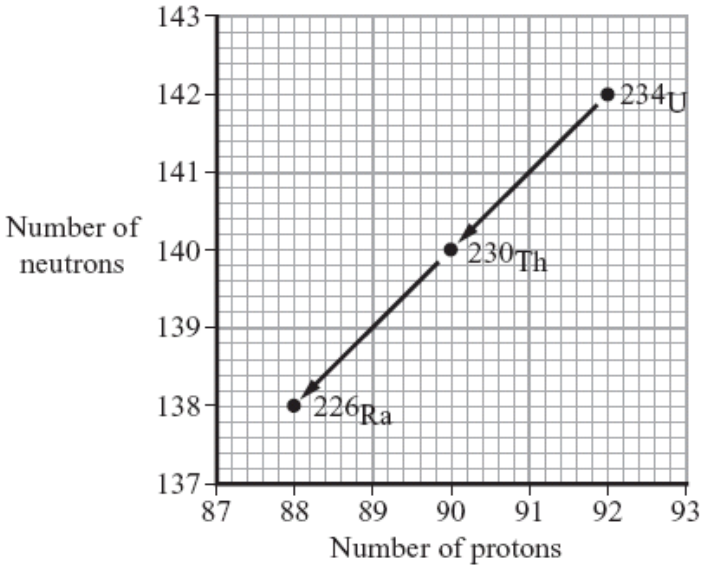

Fig. 8.1

(i) How does Fig. 8.1 show that uranium-234 (^{234}U) and thorium-230 (^{230}Th) emit alpha particles?

……

…… [1]

(ii) What makes uranium and thorium different elements?

……

…… [1]

(iii) Radioactive decay may also produce gamma radiation. Why does the emission of gamma radiation not cause a new element to be formed?

……

…… [1]

Section B

Answer **all** the questions in this section. **Q11** has a choice of section to answer.
For **Q11** use lined pages provided and, if necessary, continue on the separate sheets available from the Supervisor.

9 (a) Fig. 9.1 shows a simple manometer (not drawn to scale). It contains two liquids, water and mercury. Both ends of the manometer are open to the atmosphere. The density of water is 1000 kg/m^3, while that of the mercury is 13600 kg/m^3. Take the pressure of atmosphere as 100 kPa and the acceleration due to gravity, g as 10 m/s^2.

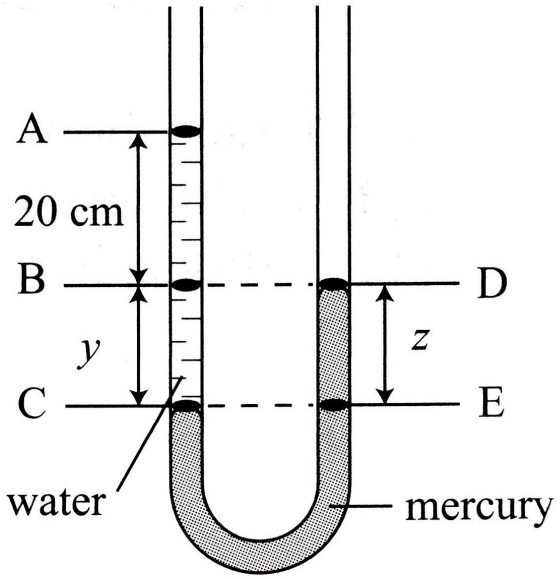

Fig. 9.1

(i) State the pair(s) of points that experience(s) the same pressure.

……[1]

(ii) Calculate the height y of the water column.

height =…… [2]

(iii) Write down the pressure at point E?

pressure =..... [2]

(b) A barometer reads 75.5 cm of mercury at the foot of a mountain and 65.5 cm of mercury at the top of the mountain.

Calculate the height of the mountain, in metres, assuming the density of mercury is 13600 kg/m^3 and the density of air is 1.25 kg/m^3.

height =..... [2]

(c) A bubble of air rises from the bottom of a pond to the surface. Just before the bubble breaks as it reaches the surface, the volume was triple its original volume.

Calculate the depth of the pond, assuming that atmospheric pressure is 1 x 10^5 Pa and density of water is 1000 kg m^{-3}.

depth =..... [3]

10 Fig. 10.1 shows a cookware sales promoter holding a saucepan. He said this,
"Come look at this fabulous special saucepan XYZ. What makes it special is its very high heat capacity. A high heat capacity means that the saucepan can reach very high temperature with very little heat. So you can start cooking very quickly and what is more, it saves you money since little heat is needed!"

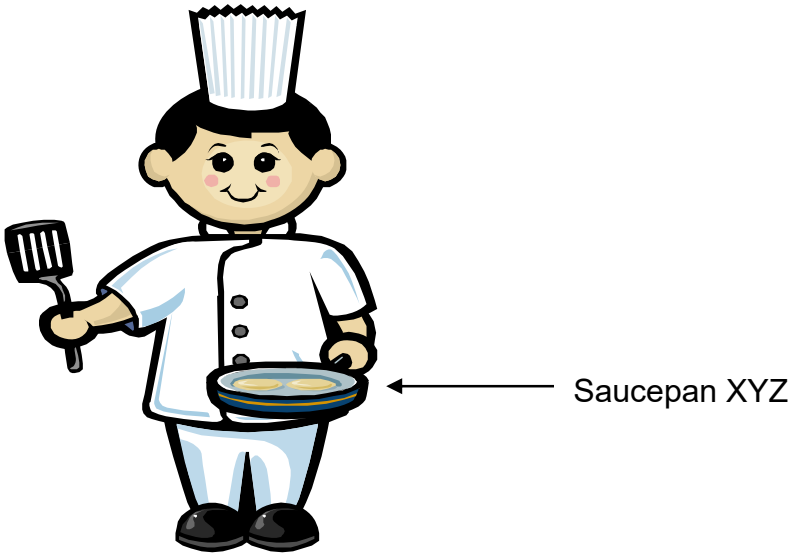

Fig. 10.1

(a) Is the statement said by the sales promoter correct? Explain.

……

……

……

…… [2]

(b) The saucepan containing 600 g of water is placed on top of a gas stove. It takes 2.0 min for the temperature of the water to rise from 30.0 °C to 50.0 °C.
The specific heat capacity of water is 4 200 J/kgK.

(i) Calculate the power supplied by the gas stove.

power =…… [2]

(ii) Find the time required to make the water boil from 50.0 °C.

time =…… [1]

(iii) When the water reaches 100.0 °C, it takes an additional 9.0 min to boil away all the water. Calculate the specific latent heat of vaporisation of water.

specific latent heat of vaporisation =…… [2]

(iv) State what is meant by *specific latent heat of vaporisation of water*.

……

…… [1]

(v) Explain whether the value calculated in **b(iv)** is higher or lower than the actual latent heat of vaporisation.

……

…… [1]

(vi) Explain why the value of specific latent heat of vaporisation of water is much greater than that of specific heat capacity of water.

……

…… [1]

11 Answer on the lined page at the end of the booklet

EITHER

A simple d.c. motor is shown in Fig. 11.1. The solenoids PQ and RS together with the coil ABCD are connected in parallel to a battery.

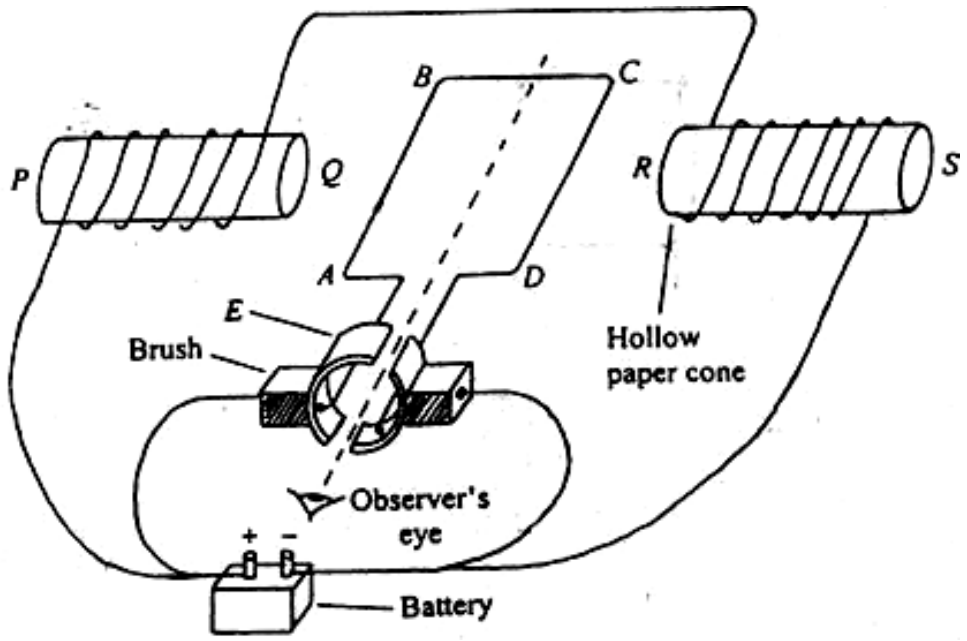

Fig. 11.1

(a) State the polarity of the solenoids at Q and R. [1]

(b) State the direction of the forces acting on the sides AB and CD. [1]

(c) In which direction would the coil rotate, as seen by the observer at O? [1]

(d) Name the component E and explain its function clearly. [3]

(e) State and explain what would happen to the rotation of the coil if the polarities of the battery are reversed. [2]

(f) Suggest two ways of decreasing the rotating speed of the coil. [2]

OR

(a) Fig. 11.2 below shows the trace on the screen of a CRO. The y-gain is set to 2.5 V/cm. The time base control is set to 5 ms/cm.

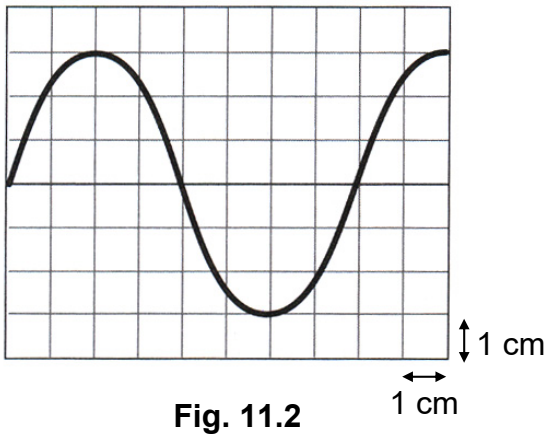

Fig. 11.2

(i) Calculate the peak value of the input. [1]

(ii) Calculate the frequency of the input voltage. [2]

(iii) Calculate the speed of the signal if the wavelength is 0.50 m. [1]

(iv) State what you would observe on the screen if the time-base control is now set at 10 ms/cm. (You may answer by sketching a diagram.) [1]

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