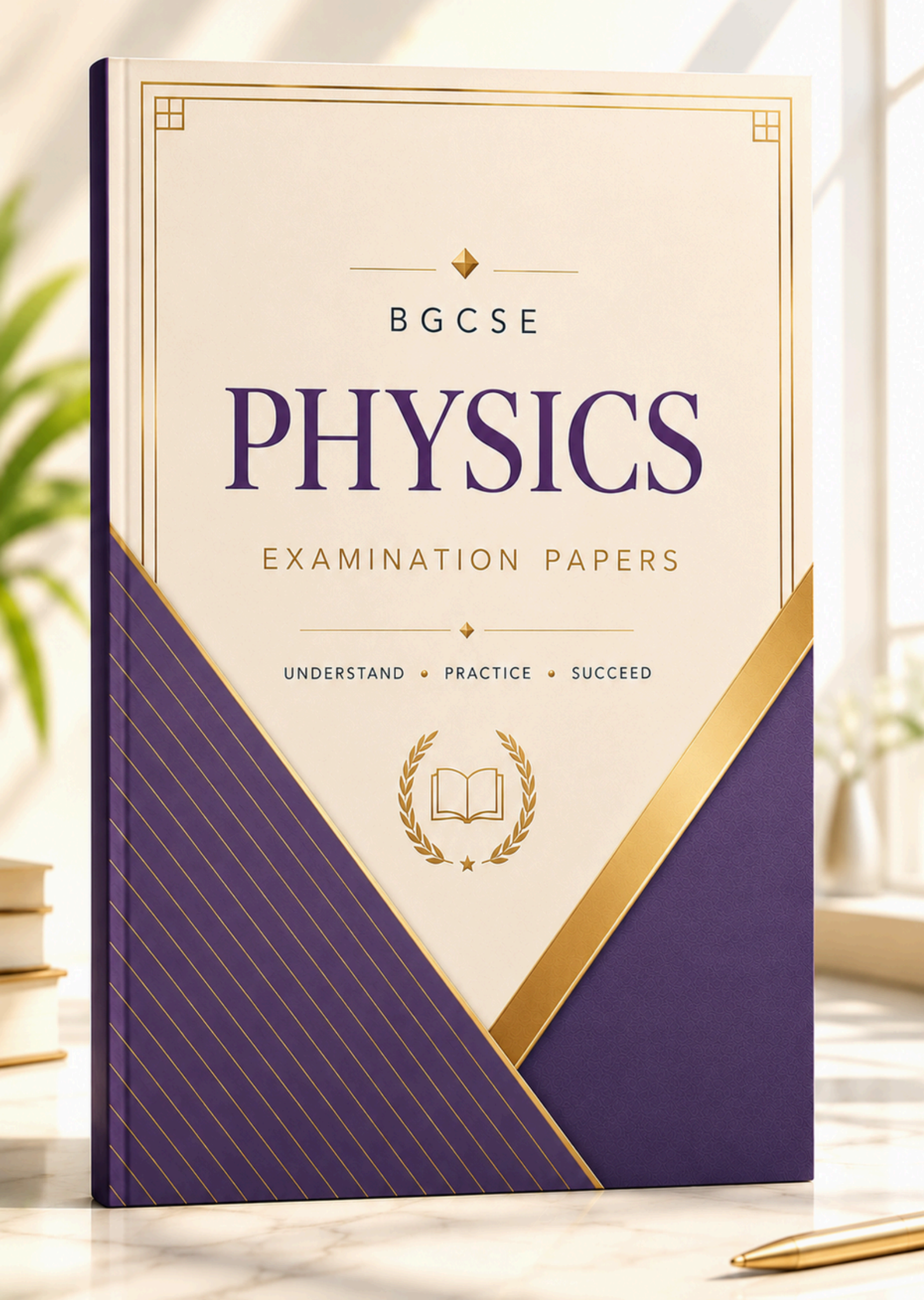
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PHYSICS

PAPER 2 3117/2

Wednesday 27 MAY 2020 1:30 P.M.–3:00 P.M.

Additional materials:
None

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INSTRUCTIONS AND INFORMATION 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** questions in this paper in the spaces provided.

Calculators may be used 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 part-question is given in brackets [ ].

This question paper consists of 16 printed pages.

1. Fig. 1.1 shows a simplified diagram of a mount designed for moving a 0.75 kg camera smoothly over short vertical distances.

When in operation, the camera is placed between a pair of sliding rails, of negligible weight and hung from a spring. The unloaded length of the spring is 2.0 cm.

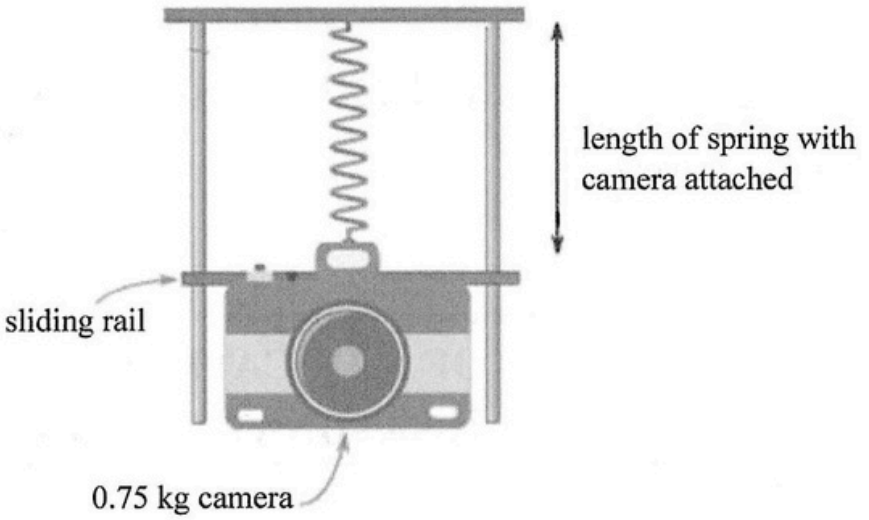


Fig. 1.1

(a) (i) Calculate the weight of the camera if the gravitational field strength acting on it is 10 N/kg.

[2]

(ii) State two property differences between mass and weight.

_____

_____

_____

_____ [2]

(b) When the camera is suspended from the spring, its new length is 5.0 cm.

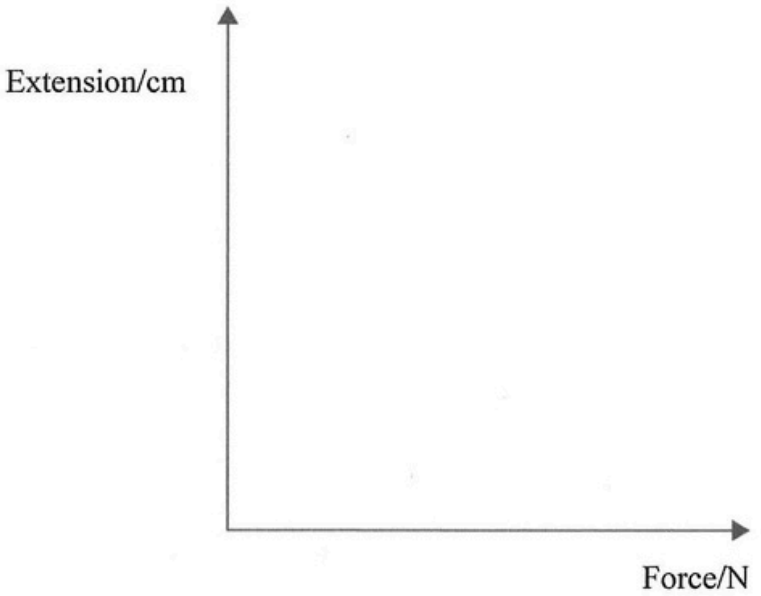
(i) What is its extension?

_____ [1]

(ii) How much force is needed to produce an extension of 4.5 cm?

[2]

(c) (i) On the axes below sketch a graph that you would expect for the spring in Fig. 1.1, **before** it reaches its elastic limit. Label this section AB.



[2]

(ii) On the graph drawn in (c)(i), sketch a section that shows the spring **beyond** its elastic limit. Label this section BC.

[1]

TOTAL MARKS [10]

2. This question is about forces and momentum.

Fig. 2.1 shows a man throwing a bowling ball of mass 7.2 kg with a starting speed of 6.25 m/s.

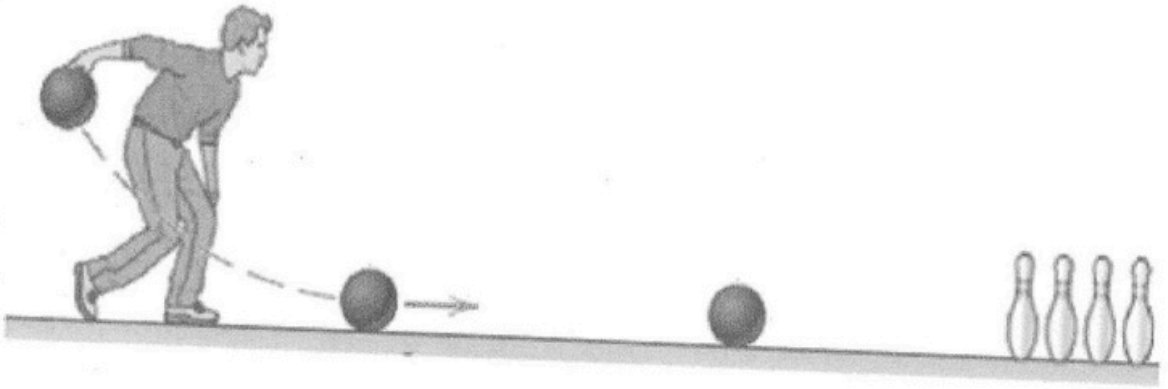


Fig. 2.1

(a) (i) Calculate the initial momentum of the ball.

[3]

(ii) What would be the effect on momentum if the same ball was bowled with a greater initial starting speed?

_____ [1]

(iii) Describe the motion of the ball along the lane, when the horizontal forces acting on it are balanced.

_____ [1]

(b) (i) Fig. 2.2 shows the forces acting on the 7.2 kg ball as it moves along the bowling lane, which is not level.

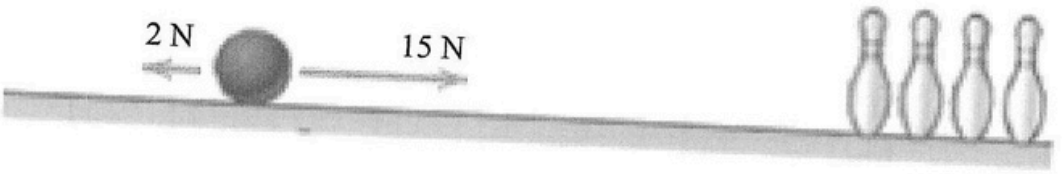


Fig. 2.2

What is the acceleration of the ball when a force of 15 N is applied to it, if 2 N of friction acts against it?

[3]

(ii) What is the relationship between the rate of change in momentum of a body and the force applied to it?

_____ [1]

(iii) Give an alternative unit for the kilogram meter per second.

_____ [1]

TOTAL MARKS [10]

3. This question is about changes of state and density.

200 g of a solid substance **X** is heated from a temperature of 30 °C to 120 °C. Fig. 3.1 shows the heating curve for this substance.

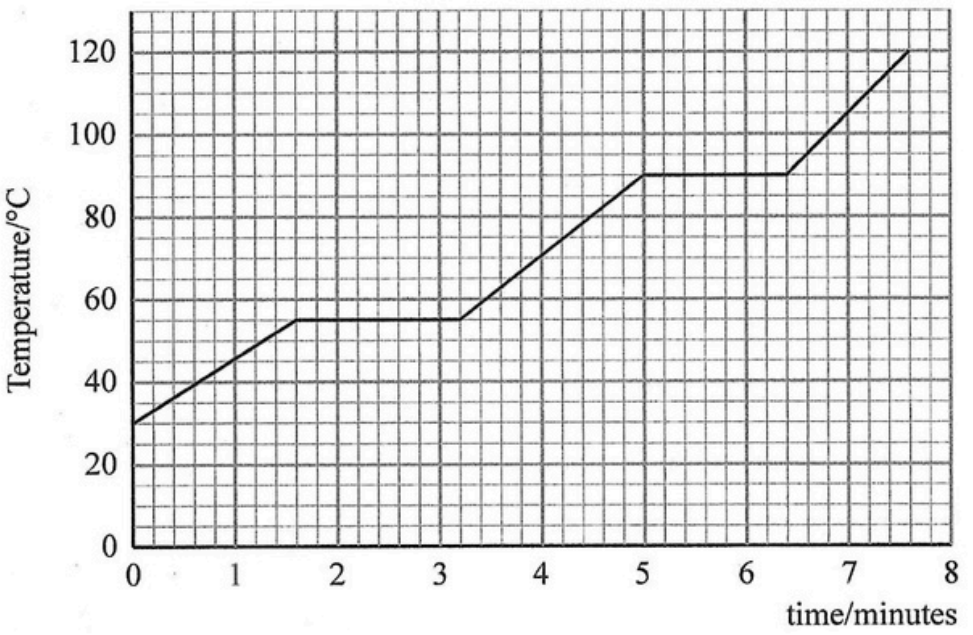


Fig. 3.1

(a) (i) State the melting and boiling points for substance **X**.

Melting point _____ [1]

Boiling point _____ [1]

(ii) What state of matter is present when the temperature is **50 °C?**

_____ [1]

(iii) How long did substance **X** exist entirely as a liquid, during heating?

_____ [1]

(b) (i) What is happening to the kinetic energy of the particles of substance **X** between 5.0 and 6.4 minutes?

_____ [1]

(ii) Give a reason for your response to (b) (i).

_____ [1]

(c) (i) If substance **X** has volume of 8.5 cm^3 at 70 °C, what is its density at this temperature?

[2]

(ii) With reference to Fig. 3.1, at which temperature would the substance **X** have the greatest density?

_____ [1]

(d) What is happening to the kinetic energy of the molecules of substance **X** when the gradient of the heating curve is steepest?

_____ [1]

TOTAL MARKS [10]

4. This question is about simple electronic circuits.

(a) Fig. 4.1 shows a **6V** battery connected to a resistor and a component **X** in series.

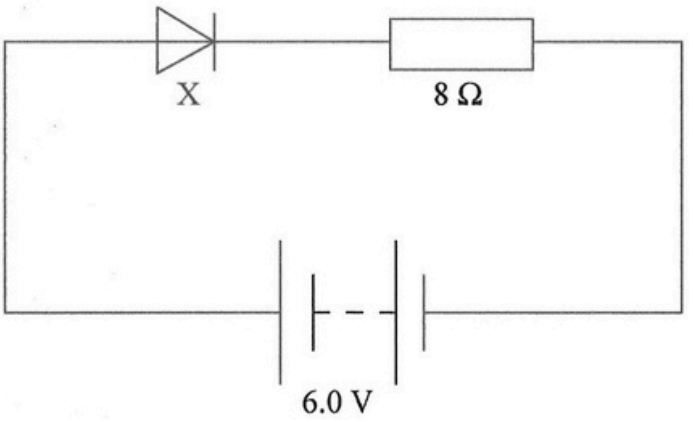


Fig. 4.1

Identify the component **X** and state its function in this circuit.

(i) Name of component **X**: _____ [1]

(ii) Function of Component **X**: _____

_____ [1]

(b) The potential difference across the 8 Ω resistor is 4.8 V.

Calculate:

The potential difference across component **X**.

[2]

The circuit in Fig. 4.1 is now modified with a 16.0 Ω resistor in parallel as shown in Fig. 4.2.

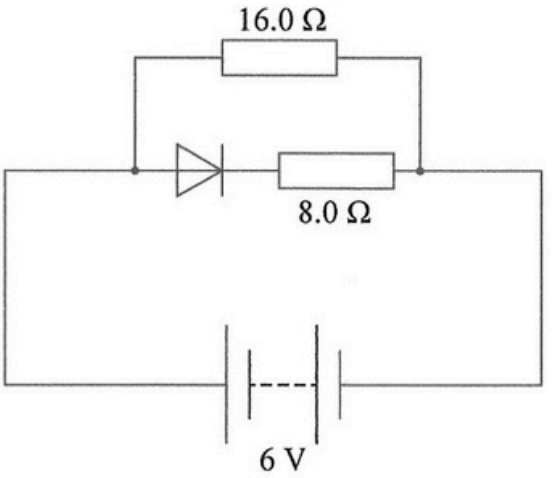


Fig. 4.2

(c) Calculate the current in the:

(i) 16.0 Ω resistor

[3]

(ii) How will the current in the battery compare to that in (c) (i)?

[1]

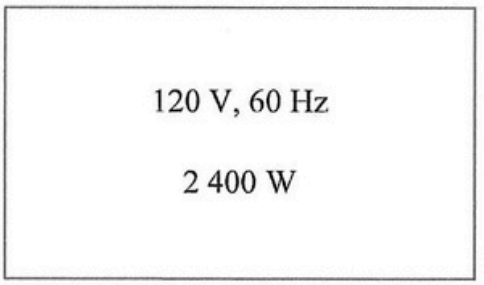
(iii) The direction of component X in Fig. 1.1 is now reversed.

State and explain, what will happen to the current in the battery.

_____ [2]

TOTAL MARKS [10]

5. A person notices the following label on the side of an electric water heater.



(a) What does the panel tell us about the heater?

(i) 120 V _____

(ii) 60 Hz _____

(iii) 2 400 W _____ [3]

(b) (i) State the energy output every second in kilojoules.

_____

_____ [1]

(ii) If the water heater was used continuously for 8 hours, how many kWh (units) of electricity will be consumed?

_____

_____ [1]

(iii) A unit of electricity costs 15 cents. Calculate the cost of operating the water heater continuously for 8 hours.

_____

_____ [1]

(c) A fuse is a safety device found in household electrical circuits.

(i) Explain how a fuse rated at 10 A operates as a safety device.

_____ [1]

(ii) An electric iron rated at 1000 W is plugged into a 120 V outlet.

Calculate the current drawn by the iron and determine if the 10 A fuse will be 'blown'.

_____

_____

_____ [3]

TOTAL MARKS [10]

6. The diagram in Fig. 6.1 shows a lens, the position of an object and the position of its image.

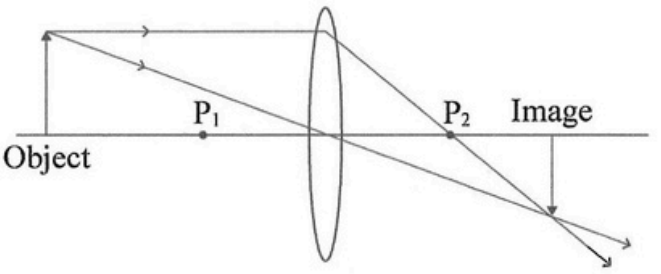


Fig. 6.1

(a) (i) What type of lens is shown in Fig. 6.1?

_____ [1]

(ii) What is the name of the point labelled P_1?

_____ [1]

(b) (i) The image in Fig 6.1 is real and can be focused on a screen. How can you tell from the diagram that the image is real?

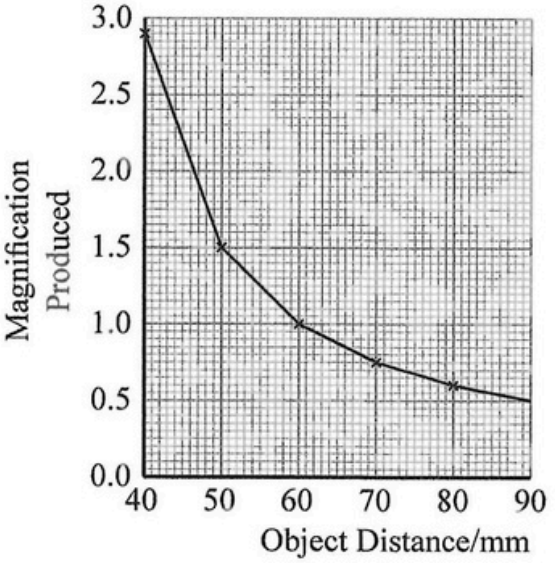
_____

_____ [2]

(ii) State two other properties of the image, other than it's real.

_____ [2]

(c) A student carried out an experiment using a lens like the one in Fig. 6.1. He measured six object and image distances, and then recorded the magnification and object distance. The results are shown in the table and graph below.



(i) Describe the relationship between the object distance and size of the image.

_____

_____ [2]

(ii) State the object distance when the size of the object and image are the same size.

_____ [1]

(d) State one practical use of this type of lens.

_____ [1]

TOTAL MARKS [10]

7. This question is about forces and motion.

Fig. 7.1 is a simplified illustration of the main forces F, acting on a swimmer and the wall as she pushes off the wall of a swimming pool. After pushing off the wall, she rises to the surface of the water and swims on the surface.

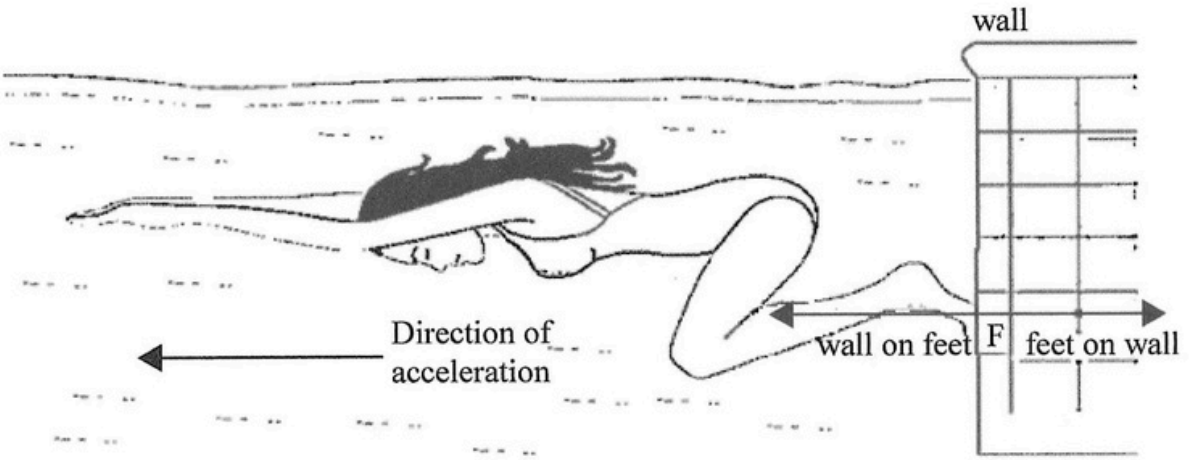


Fig. 7.1

(a) (i) Which law of motion is demonstrated by this swimmer as she pushes against the wall?

_____ [1]

(ii) Explain how the law named in (a)(i) is demonstrated as she swims on the water's surface.

_____ [1]

(b) The swimmer whose mass is 60 kg pushes off the wall of the pool with a force of 22 N.

(i) How much force is exerted on the swimmer by the wall?

_____ [1]

(ii) What is the swimmer's acceleration as she leaves the wall?

[3]

(iii) The swimmer's friend whose mass is greater, also pushes off the wall with a force of 22 N.

Compare the acceleration of the swimmer and her friend.

_____ [1]

(c) Fig. 7.2 shows a velocity-time graph which depicts the motion of the swimmer's friend during the first 15 seconds in the pool after pushing off the wall.

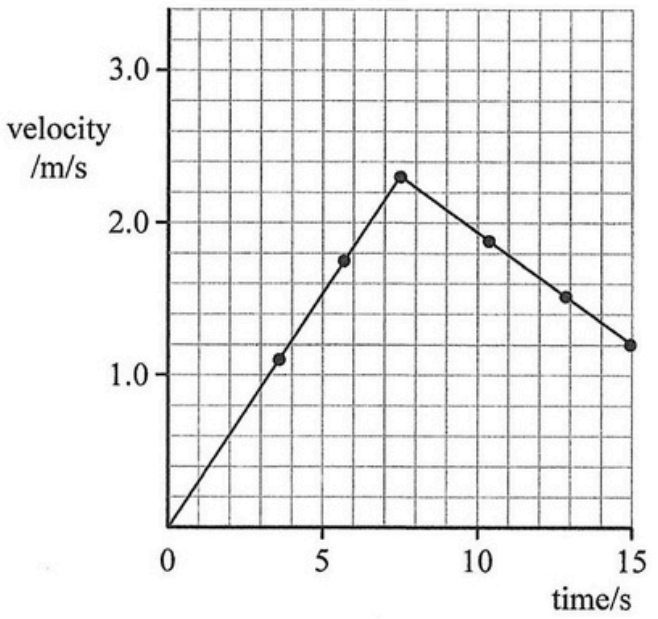


Fig. 7.2

(c) (i) Describe motion depicted from:

0 to 8 seconds _____

8 to 15 seconds _____ [2]

(ii) Give a reason for the motion of the swimmer's friend between 8 and 15 seconds compared to between 0 and 8 seconds.

_____ [1]

TOTAL MARKS [10]

8. This question is about atomic particles and radioactivity.

(a) Name the type of radioactive decay that is the most ionizing.

_____ [1]

(b) (i) An atom of radium (Ra) of mass number 226 and atomic number 88 decays by alpha emission to radon (Rn). Write the nuclear reaction for this decay in the space provided.

[2]

(ii) A sample of iodine-128 has a half-life of 25 minutes. Define the term half-life.

_____

_____ [2]

(iii) The sample of iodine-128 has a mass of 1.4 kg. Estimate how much of it is left in grams after 1.5 hours have passed.

[2]

(iv) Why would iodine-128 be suitable as a medical tracer?

_____ [1]

(c) Carbon dating is another use for radioactive isotopes. Define isotope and state the isotope of carbon that is used for this purpose?

_____

_____ [2]

TOTAL MARKS [10]

[End