Class	Register Number	Name

南洋女子中学校
NANYANG GIRLS' HIGH SCHOOL
End-of-Year Examination 2014
Secondary Four

PHYSICS **1 hour 45 minutes**
Paper 2 Theory Paper **09:15 – 11:00**
Friday **3 October 2014**
Additional materials: Calculators may be used

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, register number and class in the spaces at the top of this page and on any separate answer paper used.

Section A (40 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B (30 marks)
Answer **all** questions including questions **10, 11 and 12 *Either* or 12 *Or*.**
Write your answers in the spaces provided on the question paper.

At the end of the examination, circle **12 Either** or **12 Or** in the grid on the right to indicate which question you have answered.

INFORMATION FOR CANDIDATES
The intended number of marks is given in the brackets [ ] at the end of each question or part question. You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

Take gravitational field strength, g, to be 10 m s^{-2} or 10 N kg^{-1}.

Examiner's Use	
Paper 2	
1	
2	
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5	
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9	
10	
11	
12 Either	
12 Or	
Total	

Paper 1	

Overall
%

Section A
Answer **all** questions.

Write your answers in the spaces provided.

1 Fig. 1.1 shows the velocity-time graph of a ball being thrown vertically downwards at a certain height above the ground. You may assume that there is no air resistance as the ball travels.

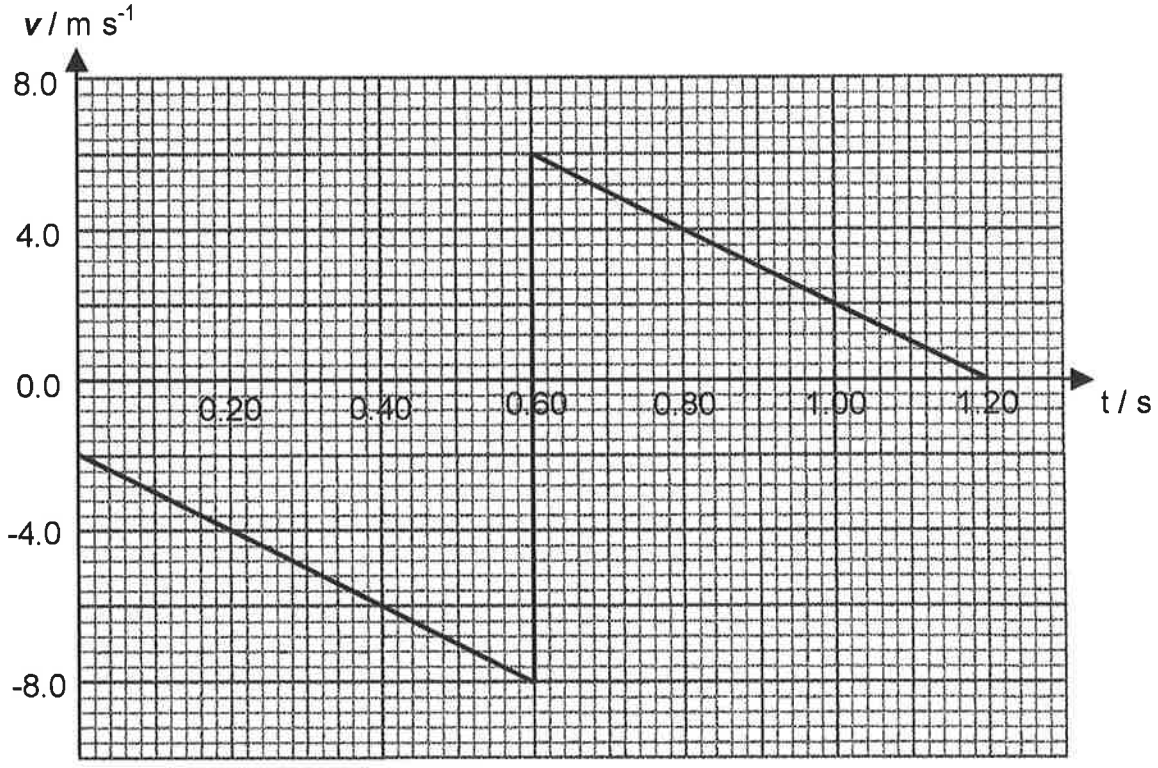


Fig. 1.1

(a) State the sign convention of the graph in Fig. 1.1.

..... [1]

(b) Describe the motion of the ball from t=0 s to 1.2 s.

.....

..... [2]

(c) Calculate the height above the ground at which the ball was thrown.

height = ... [2]

(d) Calculate the displacement of the ball from t=0 s to 1.2 s.

displacement = ... [2]

2 Fig. 2.1 shows a lifting mechanism for hoisting a bicycle onto a ceiling storage system.

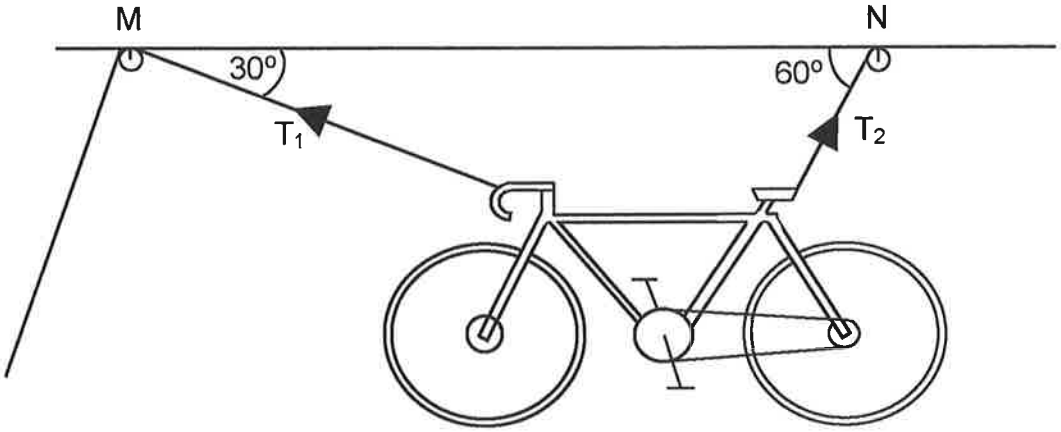


Fig. 2.1

M and N are two smooth pulleys fixed on the ceiling. The bicycle weighs 98 N and the two cables supporting the bicycle make angles of 30° and 60° with the ceiling as shown.

(a) By drawing a scaled diagram or otherwise, determine the magnitude of the tensions T_1 and T_2 in the two cables.

T_1 = ... T_2 = ... [3]

(b) Suggest a possible modification that can be made to the lifting mechanism to reduce the tensions in the cables.

.....

..... [1]

3 Fig. 3.1 shows an athlete who is trying to strengthen her leg muscles. She uses the machine shown. Her two heels apply a force **F** to the steel bar with padding and produce a moment about the pivot to lift a 300 N weight.

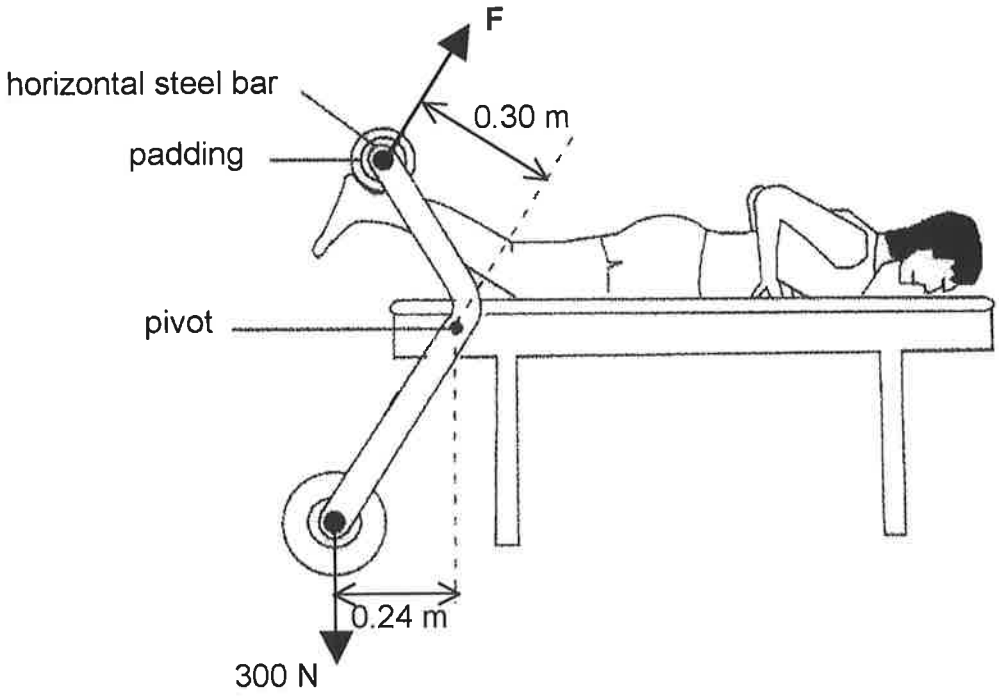


Fig. 3.1

(a) Define the moment of a force.

.....

.....

..... [1]

(b) Calculate the magnitude of the force, **F** when the weight is in the position shown in Fig. 3.1.

force, **F** = ... [2]

(c) Explain why the padding on the narrow steel bar makes the athlete feel more comfortable when lifting the weights.

.....

.....

..... [1]

4 Fig. 4.1 shows a fishing boat using ultrasound (SONAR) to detect shoals of fish under the sea.

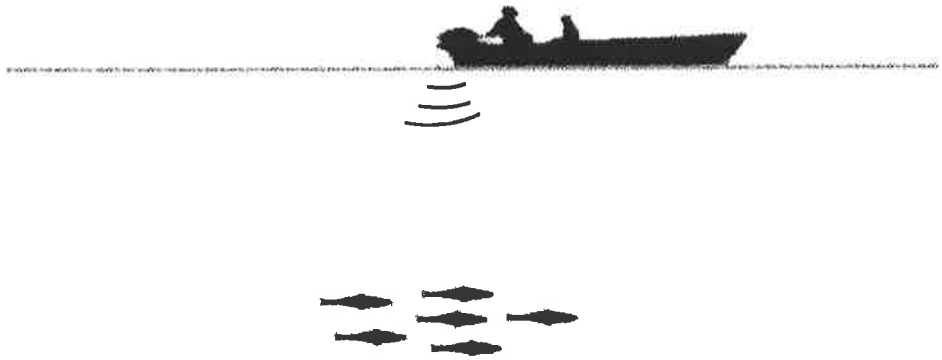


Fig. 4.1

(a) Given that the speed of ultrasound in seawater is 1500 m s^{-1} and the shoal of fish is at a depth of 420 m, calculate the time it takes for the boat to detect a pulse of ultrasound after emitting the pulse towards the fish.

time taken = ... [2]

(b) Fig. 4.2 below shows the waveform of a pulse of ultrasound captured by a C.R.O. on the boat.

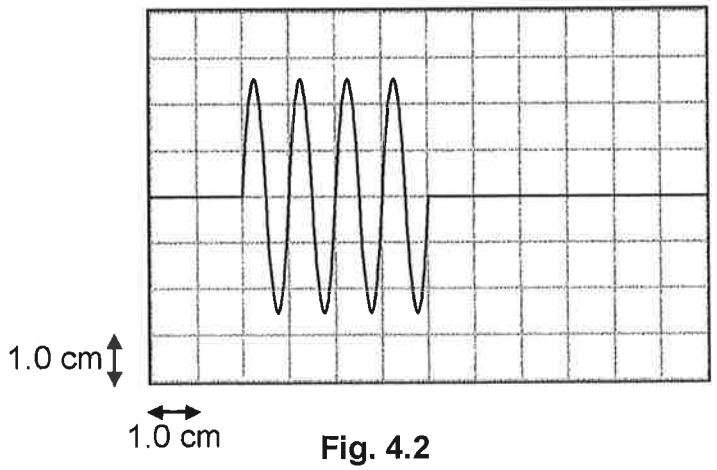


Fig. 4.2

(i) Does ultrasound travel as a transverse wave through water? Explain.

.....

..... [1]

(ii) If the time-base is set to 2.5 ms cm^{-1}, determine the duration of the pulse shown in Fig. 4.1.

duration of pulse = ... [1]

(c) A bubble of gas rises from the shoal of fish to the surface of the sea.

(i) The pressure of the atmosphere is 100 kPa and the density of seawater is 1030 kg m^{-3}. Calculate the pressure in the bubble at a depth of 420 m.

pressure = ... [2]

(ii) If the size of the bubble is 2.0 mm^3 at the depth of 420 m, calculate the size of the bubble just before it reaches the surface of the sea.

size of bubble = ... [2]

5 Fig. 5.1 shows an experimental setup to study the image of an illuminated object formed by a convex lens L.

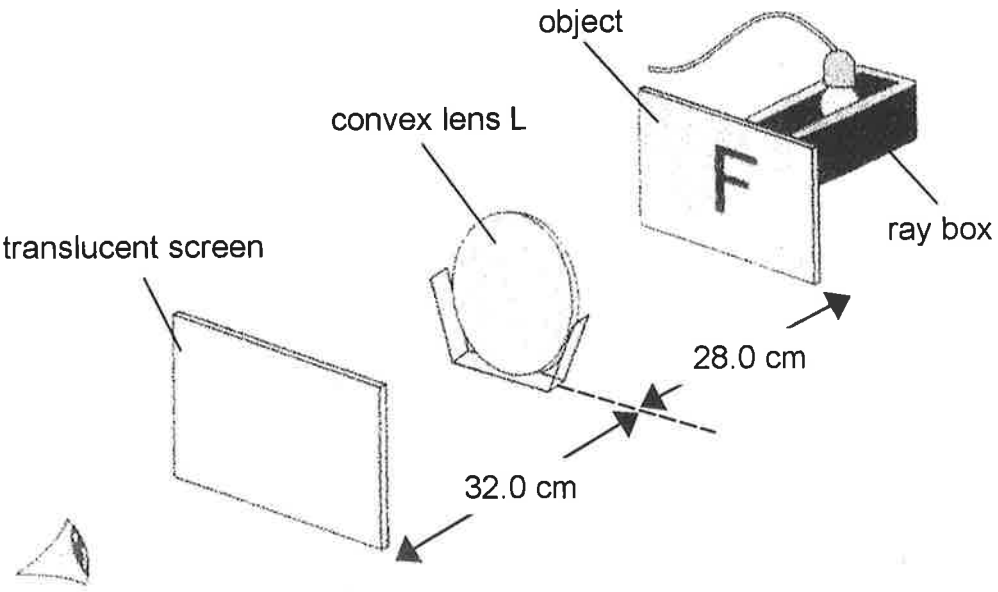
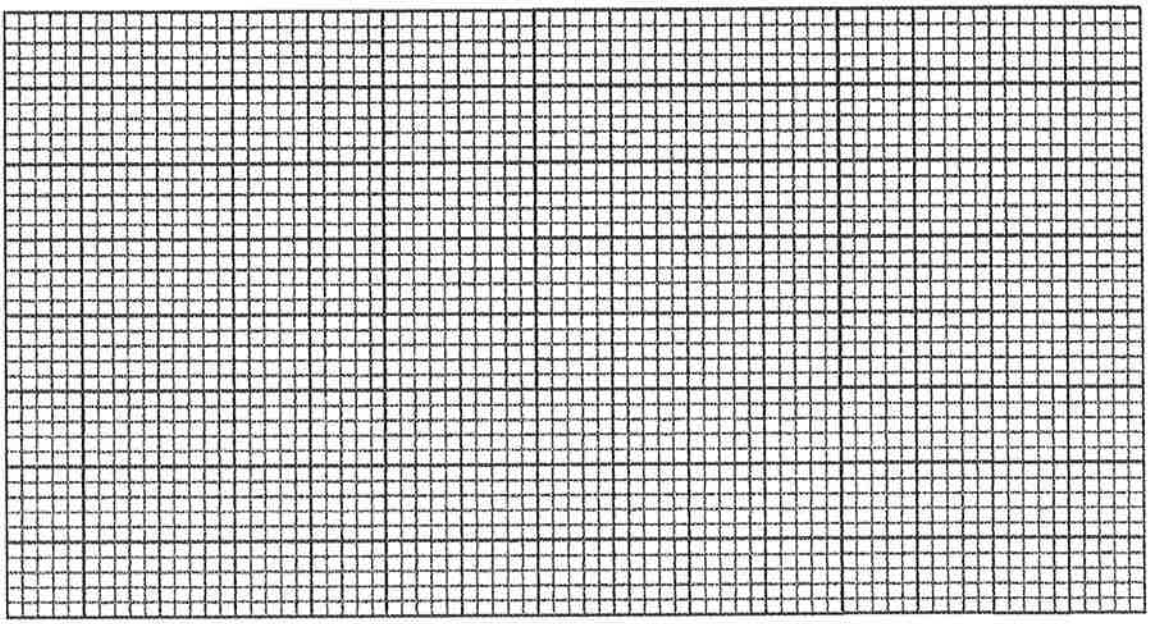


Fig. 5.1

When the illuminated object is placed 28.0 cm from the lens, a sharp image forms on the translucent screen at a distance of 32.0 cm from the lens.

(a) On the translucent screen in Fig. 5.1, carefully draw the image formed as seen by the eye. [1]

(b) On the grid below, draw a ray diagram to show how the image is formed by the lens. Indicate clearly the object, the image, 2 light rays and the position of the lens. [2]



(c) Using the ray diagram, determine the focal length of the lens.

focal length = ... [1]

(d) A piece of paper is used to cover the top half of the lens as shown in Fig. 5.2.

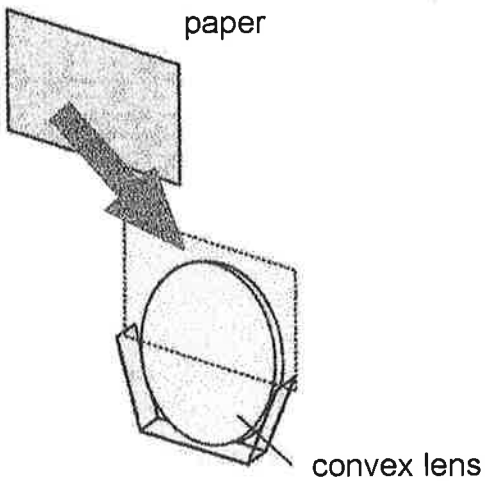


Fig. 5.2

Describe how it will affect the image formed on the screen.

.....

..... [1]

6 Fig. 6.1 shows the wavefronts as water waves travel from region A to region B. Each wavefront represents a crest.

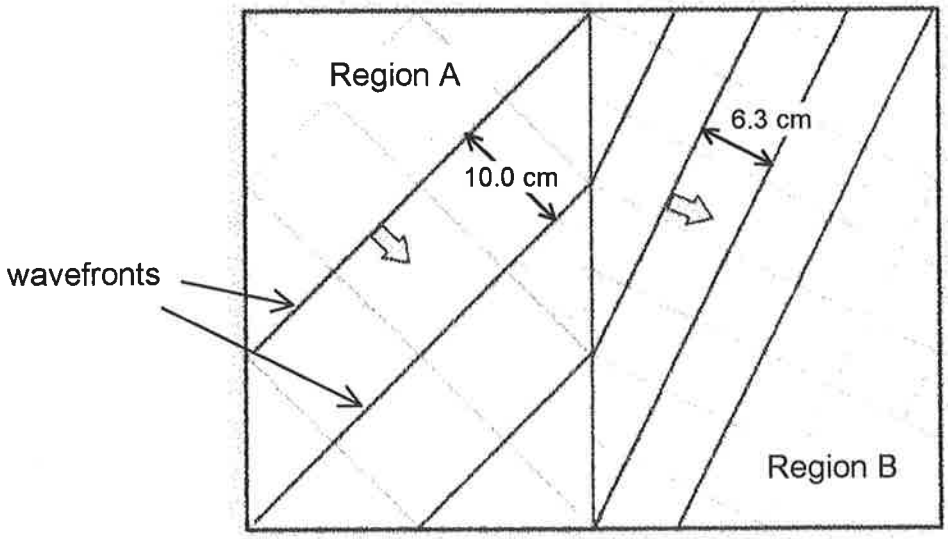


Fig. 6.1

The distance between adjacent wavefronts in A and B are 10.0 cm and 6.3 cm respectively. If the speed of the wave in A is 20 cm s^{-1}, calculate

(a) the frequency of the water wave,

frequency = ... [2]

(b) the speed of the water wave in region B.

speed = ... [2]

7 In the circuit shown in Fig 7.1 below, the resistance of the battery and the meters may be ignored. The switch S is initially **closed**.

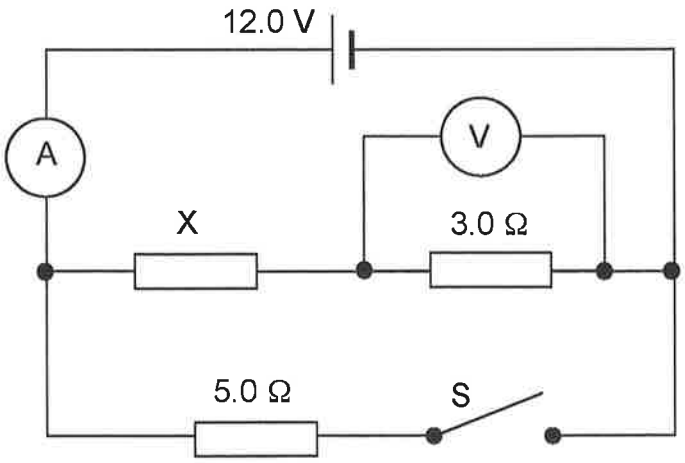


Fig. 7.1

(a) Given that the voltmeter reads 4.0 V, calculate the value of resistor X.

resistance X = ... [1]

(b) Calculate the reading on the ammeter.

ammeter reading = ... [2]

(c) State the changes, if any, that would be observed on the ammeter and voltmeter when S is opened.

.....

.....

.....

..... [1]

8 A positively charged rod is held close to a metal sphere as shown in Fig. 8.1 below.

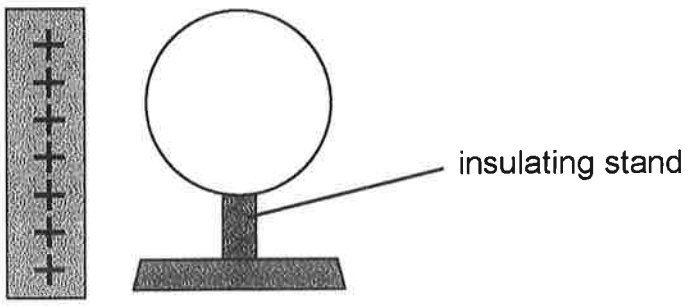


Fig. 8.1

(a) Complete Fig. 8.1 to show the distribution of charge on the sphere. [1]

The sphere is then earthed as shown in Fig. 8.2.

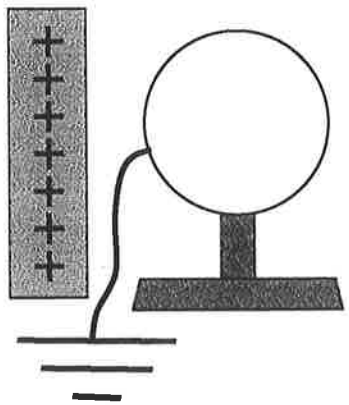


Fig. 8.2

(b) Complete Fig. 8.2 to show the new distribution of charge on the sphere. [1]

9 Fig. 9.1 below shows a partial circuit consisting of a battery, a fixed resistor R, and a bulb.

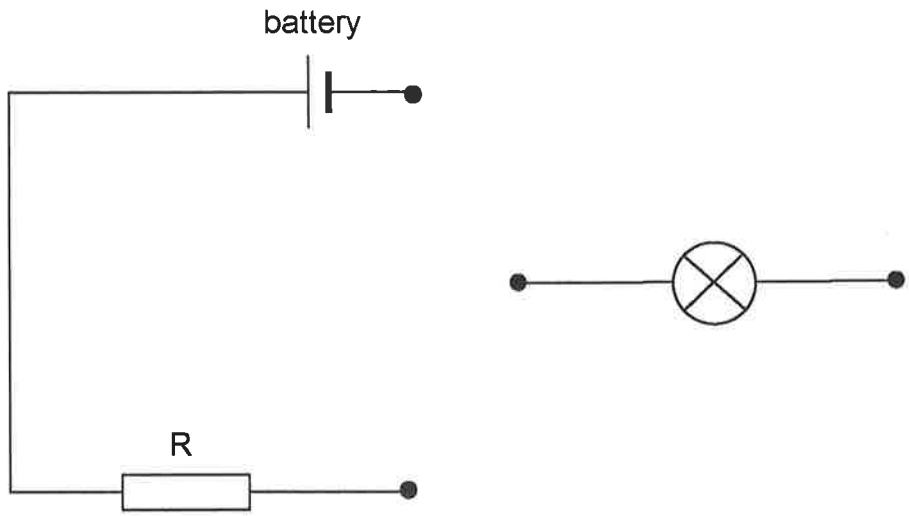


Fig. 9.1

Complete the circuit in Fig 9.1 to include a thermistor which will cause the bulb to get **brighter** as the temperature **decreases**. [2]
(*Assume that the resistance of the thermistor decreases with temperature.*)

Section B

Answer all **three** questions from this section.

Question 12 is in the form of either/or and only **one** of the alternatives should be attempted.
Each question carries **ten** marks.

10 Fig. 10.1 shows a student performing an experiment to study the motion of the school's lift as it moves upwards. She stands on a bathroom scale.

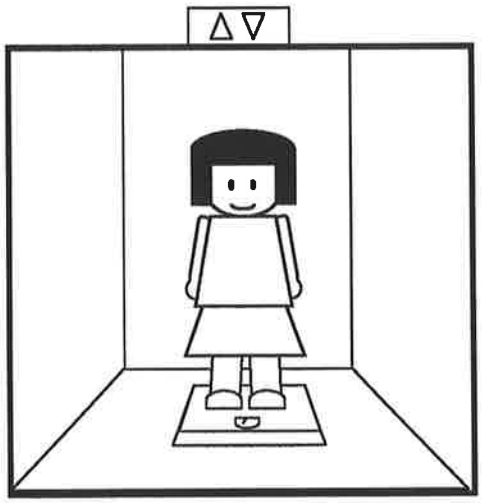


Fig. 10.1

The reading on the bathroom scale is 460 N when the lift is at rest.

(a) The weight of the lift is 1500 N. It raised the student up a height of 7.8 m in 4.0 s. Calculate

(i) the work done by the motor of the lift,

work done = ... [2]

(ii) the average power of the motor of the lift.

average power = ... [1]

(b) The table below shows the reading on the scale recorded by the student during the upward journey at intervals of 0.5 second.

Time / s	Scale reading / N
0.0	560
0.5	560
1.0	460
1.5	460
2.0	460
2.5	460
3.0	460
3.5	460
4.0	340
4.5	340
5.0	460

(i) Explain why the reading on the bathroom scale changes.

.....

.....

.....

.....

..... [2]

(ii) Calculate the initial acceleration of the lift.

initial acceleration = ... [2]

(iii) Calculate the deceleration of the lift.

deceleration = ... [2]

(iv) Describe the motion of the lift when the reading on the scale reads 0.0 N. Assume the student remains standing on the scale.

.....

.....

..... [1]

11 A hot water shower has a heating element in a tank that is positioned as shown in Fig. 11.1 below.

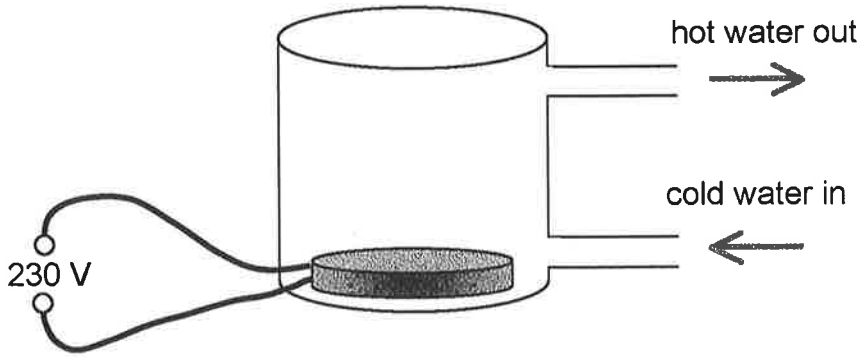


Fig. 11.1

(a) Explain why the heating element is placed at the bottom of the hot water tank.

.....

..... [1]

The tank has a capacity of 80 kg and is initially full of water at 30 °C. In order to take a shower the water has to be heated up to 65 °C. The heating element of the heater is rated as 230 V, 1.8 kW.

(b) Calculate the heat energy that is required to heat the tank full of water to 65 °C.
(*Take the specific heat capacity of water to be 4200 J kg^{-1} K^{-1}*)

heat energy = ... [2]

(c) Calculate the time taken for the water to heat up.

time taken = ... [2]

(d) Given that the cost of electricity to be 22¢ per kWh, calculate the cost of heating the tank of water.
(*Give your answer to the nearest 1¢.*)

cost of heating water = ... [2]

(e) State **two** ways you could modify the outside of the tank to reduce heat loss from the tank. Explain what type of heat flow is being reduced and how your modification will help reduce heat flow from the tank.

.....

.....

.....

.....

.....

.....

.....

..... [3]

12 EITHER

Fig. 12.1 shows a solenoid which is connected to a battery so that the current flows in the direction shown.

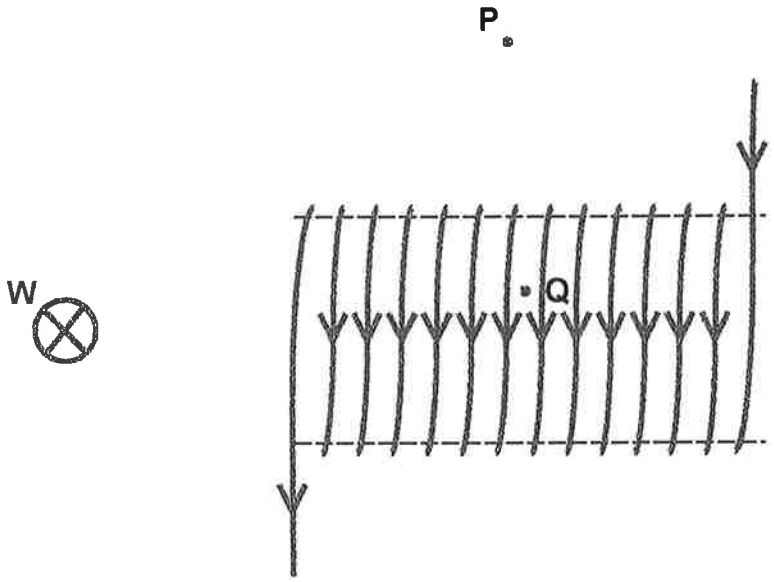


Fig. 12.1

(a) On Fig. 12.1 draw the pattern of the magnetic field due to the current, both inside and outside of the coil. [2]

(b) Draw arrows at points P and Q to indicate the direction of the magnetic field at these points. [2]

(c) A wire W shown in cross-section in Fig.12.1, carries a current perpendicularly into the diagram. Indicate, with an arrow, the direction of the force exerted on W. [1]

(d) State **two** ways in which the force on wire W could be increased.

.....

.....

.....

..... [2]

A metal bar is inserted into the solenoid as shown in Fig. 12.2 below.

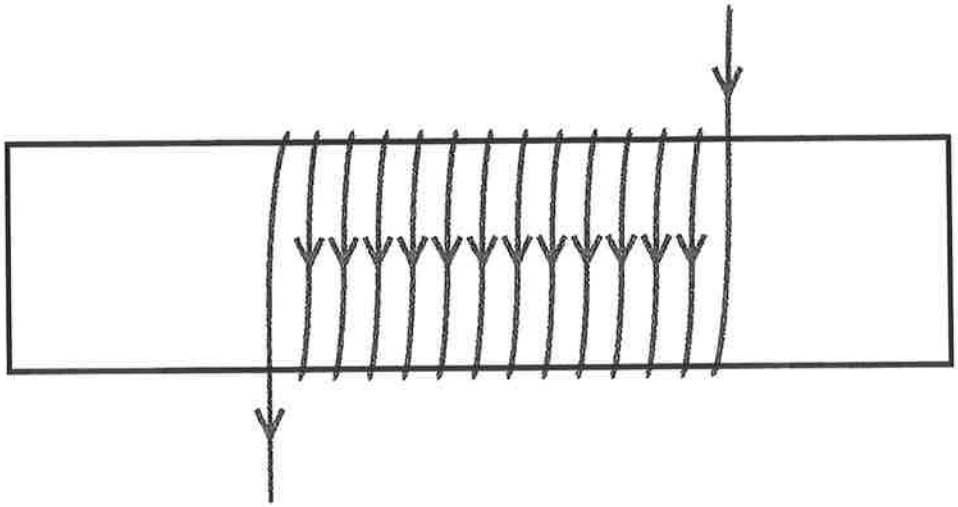


Fig. 12.2

(e) Clearly indicate on Fig. 12.2, the position of the poles induced in the metal bar. [1]

(f) State, with an explanation, which metal you would use for the bar if you wanted an electromagnet.

.....

.....

..... [2]

12 OR

Fig. 12.3 below shows an a.c. generator being used to light a small bulb.

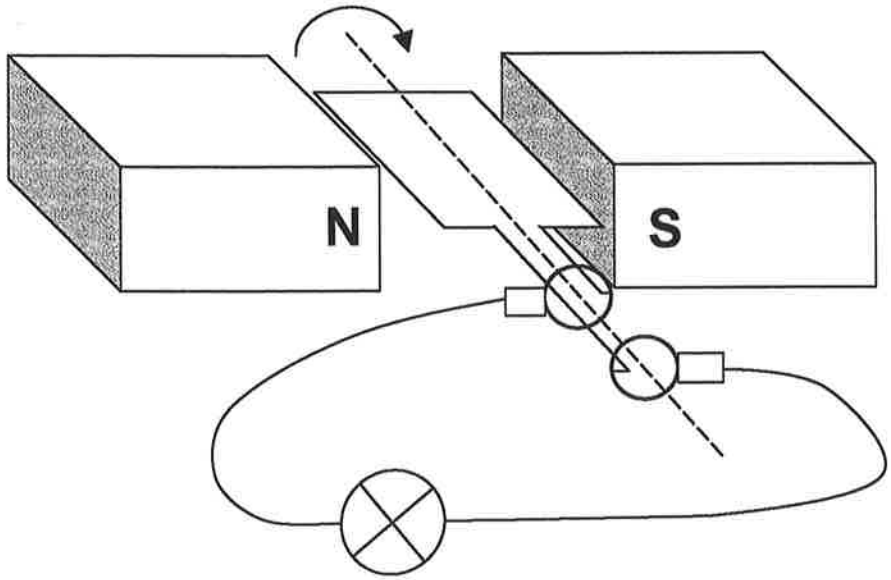


Fig. 12.3

When the coil is rotated, an e.m.f. is produced in the coil.

(a) Explain why an e.m.f. is produced.

.....

.....

..... [2]

(b) State the purpose of the slip rings.

.....

..... [1]

(c) At the instant shown in the Fig. 12.3, indicate clearly on Fig. 12.3,

(i) the direction of the induced current in the coil, [1]

(ii) the direction of forces on both sides of the coil due to the induced current in the coil. [1]

(d) State how the answers to **(c)** would be different if the light bulb is removed (and the circuit is left opened).

.....

.....

..... [1]

(e) State **two** changes that could be made to the generator to make the bulb glow brighter.

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.....

.....

..... [2]

(f) Fig. 12.4 shows the variation of current flowing through the bulb as the generator coil is rotated at 20 Hz.

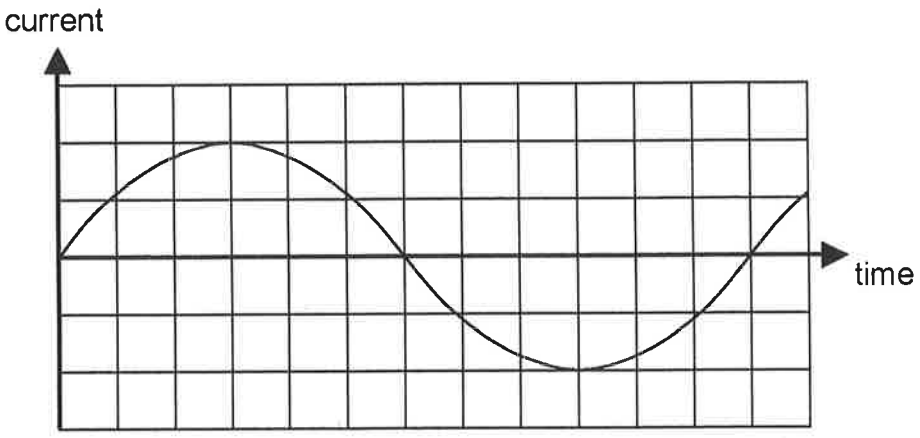

Fig. 12.4

On Fig. 12.4, draw the output from the same generator when the rate of rotation of the coil is increased to 30 Hz. [2]

End of paper