Name:	Form Class	Index No		Teaching Group			

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UNITY SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

SCIENCE (PHYSICS, CHEMISTRY) 5086/02 **28 Aug 2024**

Paper 2 Physics

1 hour 15 minutes

Additional Materials: Nil

MARKS	/65

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluids.
Write your Name, Form Class, Index Number and Teaching Group on the Question Paper and Answer Sheet in the spaces provided.

Section A
Answer **all** questions.
Write your answers in the spaces provided.

Section B
Answer **one** question.
Write your answers in the spaces provided.

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

This paper consists of **14** printed pages, including this cover page.

[Turn over

Section A

Answer **all** the questions in the spaces provided.

1 A man makes a parachute jump. Initially, he falls without opening his parachute. Then he opens his parachute and falls to the ground.

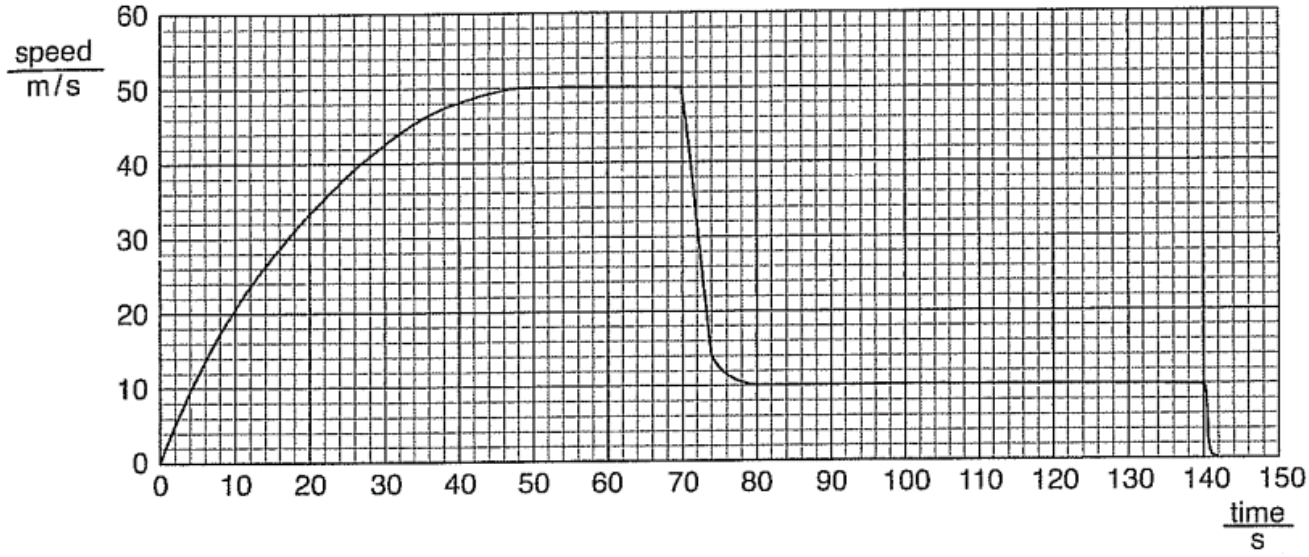

Fig. 1.1

Fig. 1.1 shows how his speed changes with time after jumping.

(a) State the two times in which the man has a non-zero uniform acceleration in between.

The man has a non-zero uniform acceleration between ..... s and ..... s [1]

(b) State the time at which the man opens his parachute.

.....[1]

(c) Calculate the distance through which the man falls between 50 s and 70 s.

distance = ... m [3]

2 A rocket has a mass of 500 kg. The gravitational field strength is 10 N/kg.

(a) Calculate the smallest upward force that is needed for the rocket to take off. State the unit.

force = ... [2]

(b) The rocket reaches a speed of 600 m/s in 3.0 s.

(i) Calculate the average acceleration of the rocket. State the unit.

acceleration = ... [2]

(ii) Calculate the average force needed to give this acceleration. Assume that the mass of the rocket remains constant. State the unit.

force = ... [2]

3 Fig. 3.1 shows a uniform metre rule of mass 120 g suspended at its mid-point from a spring balance which is calibrated in newton (N).

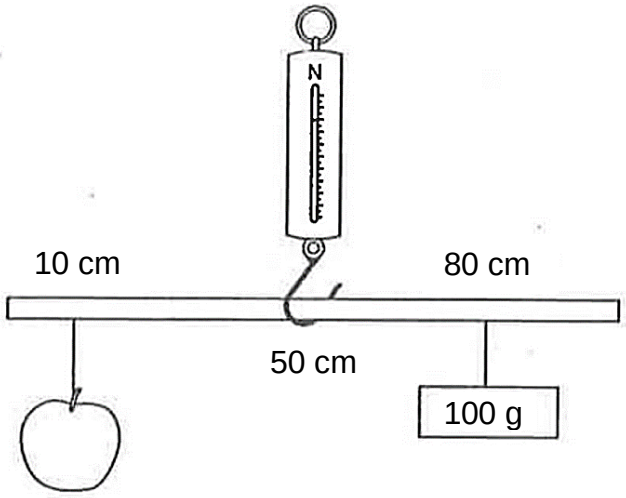

Fig. 3.1

An apple, suspended from the metre rule at the 10 cm mark, is balanced by a 100 g mass suspended from the 80 cm mark. Assume g = 10 N/kg.

(a) Calculate the mass of the apple. Show your working.

mass = ... g [3]

(b) Explain why the mass of the metre rule play no part in the calculation in **(a)**.

.....

.....

.....[2]

(c) Determine the reading on the spring balance.

reading = ... N [3]

4 An object of mass 400 g is set into motion so that it slides up a slope with an initial speed of 6 m/s. The object comes to rest after reaching a height of 1.5 m.

Calculate, for this object,

(a) its initial kinetic store,

kinetic store = ... J [2]

(b) and its gravitational potential store at height of 1.5 m.

gravitational potential store = ... J [2]

(c) Explain the energy pathway that brings about the energy transfer as the object moves up the slope.

.....

.....

.....

.....

.....[3]

5 Some ice floats inside a container of water. The water temperature decreases.

(a) Describe what happens to the internal energy and the kinetic energy of the water as its temperature decreases.

.....

.....[2]

(b) By considering the arrangement of the molecules in ice and water, suggest why ice floats on water.

.....

.....

.....[2]

6 A sound wave is emitted downwards from a ship. The sound wave is reflected from the seabed and is detected as it arrives back at the ship. See Fig. 6.1 below.

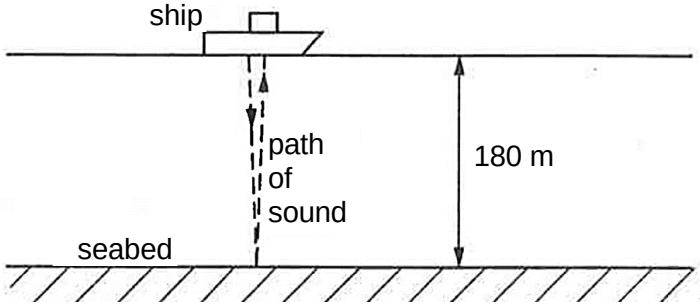

Fig. 6.1

The time between emitting the sound wave and detecting it back at the ship is 0.25 s. The seabed is 180 m below the ship.

(a) State the nature of sound waves.

.....[1]

(b) Explain how sound waves travel through the sea water.

.....

.....

.....[2]

(c) Calculate the speed of sound in seawater.

speed = ... m/s [3]

7 Fig. 7.1 shows refraction of blue light at the boundary between air and glass.

(The angles have not been drawn with their exact values.)

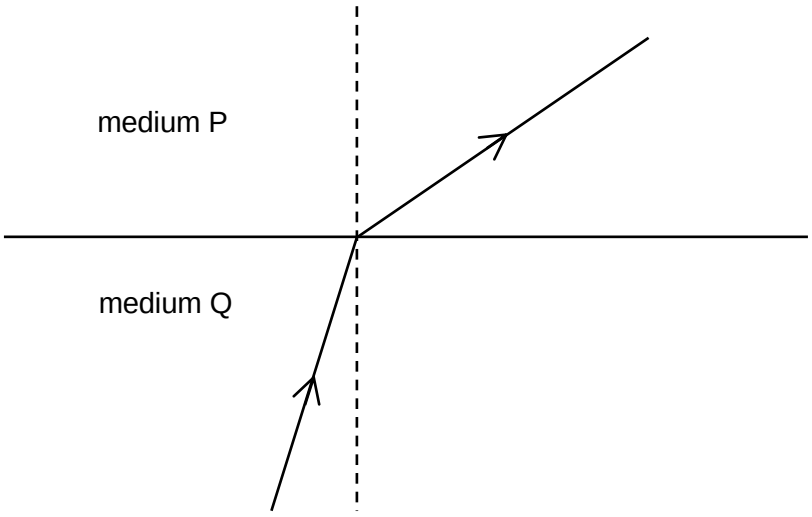

Fig. 7.1

(a) State and explain which medium, P or Q, represents the glass.

.....

.....

.....[2]

(b) Blue light travels at 3.0×10^8 m/s in air and 2.1×10^8 m/s in the glass.

Calculate the refractive index of the glass for blue light.

refractive index = ... [2]

8 Some electrical appliances have metal case that has an earth wire connected to it.

(a) Explain why it is called an *earth wire*.

.....

.....[1]

(b) A fuse is connected in the live wire of the circuit that includes the appliance.

(i) Explain how you would choose the rating of the fuse to be used in the circuit.

.....

.....

.....[2]

(ii) Explain why the fuse is connected in the live wire.

.....

.....

.....[2]

9 Fig. 9.1 shows a machine that is used to produce aluminium foil of constant thickness. The radioactive source emits radiation that passes through the aluminium to the detector. If the amount of radiation reaching the detector changes, a signal is sent to rollers to adjust the pressure oof the rollers.

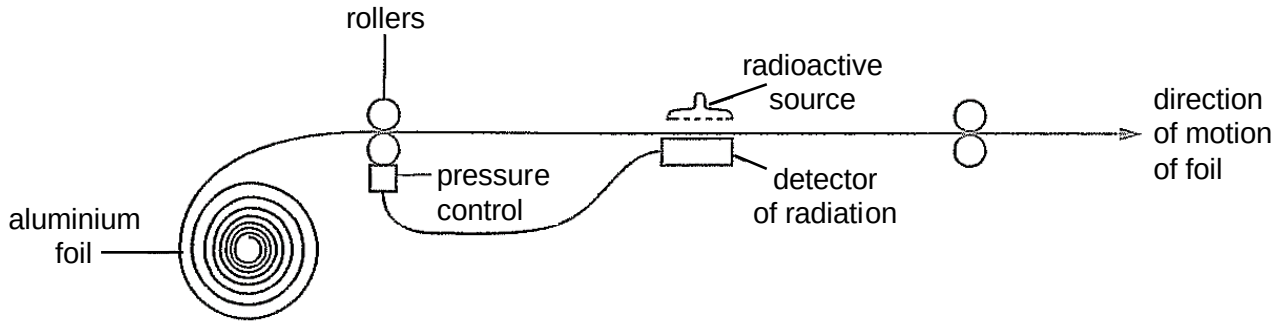

Fig. 9.1

(a) The aluminium foil passing the detector becomes thicker. Describe how the machine makes sure that the thickness of the foil returns to its original value.

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.....

.....[2]

(b) Fig. 9.2 is a table giving some properties of four radioactive sources.

radioactive source	type of radiation emitted	half-life
A	α (alpha)	450 years
B	β (beta)	2 days
C	β (beta)	68 years
D	γ (gamma)	253 years

Fig. 9.2

For each source, suggest and explain whether it can be used to control the thickness of the aluminium.

Radioactive source A: .....

.....

.....

Radioactive source B: .....

.....

.....

Radioactive source C: .....

.....

.....

Radioactive source D: .....

.....

.....[6]

(c) Fig. 9.3 shows how the activity of a radioactive source changes with time.

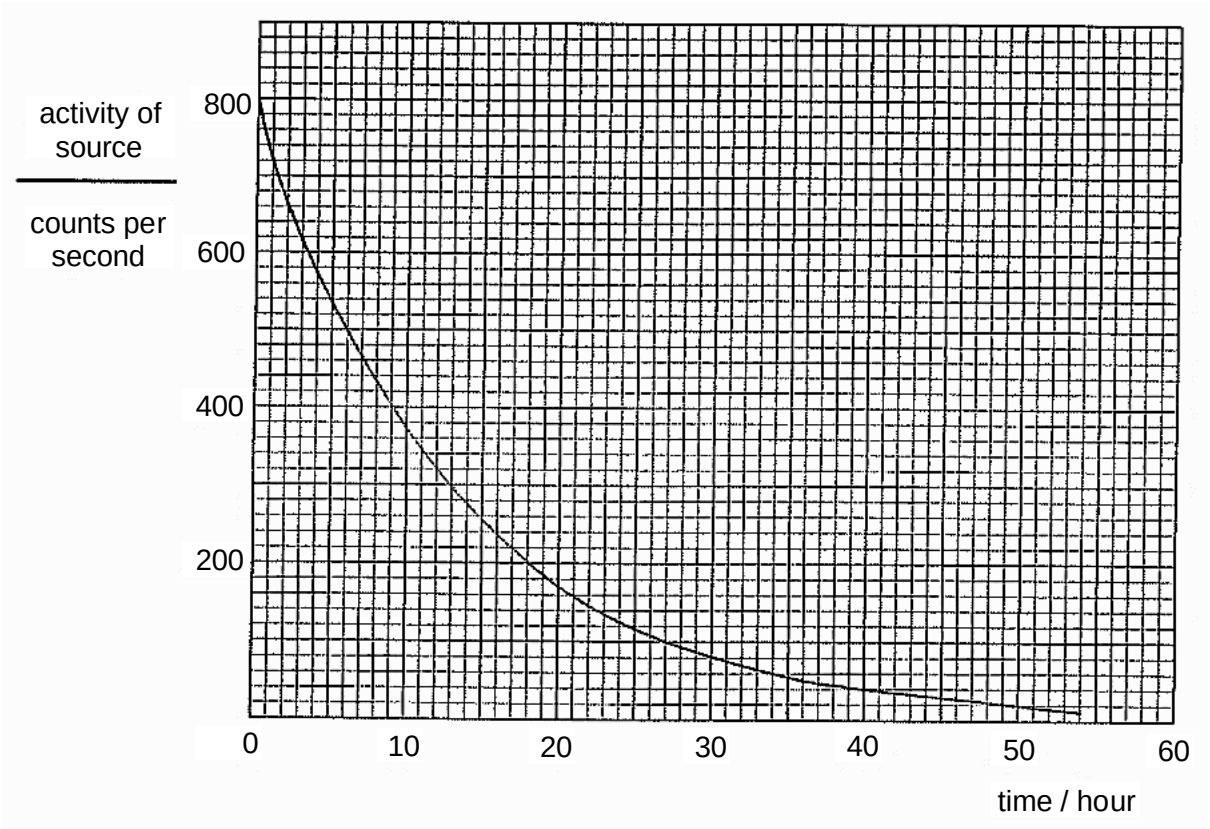

Fig. 9.3

(i) Use the graph to calculate a value for the half-life of the radioactive source.

half-life = ... h [1]

(ii) Explain clearly how you obtained your answer.

.....

.....[1]

Section B

Answer only **one** question.
Write your answers in the spaces provided.

10 **(a)** Three wires, X, Y and Z, are made from the same material.
Wire X has area of cross-section A and length l. Its resistance is 6 Ω.
Wire Y has area of cross-section A and length $2l$.
Wire Z has area of cross-section $2A$ and length l.

Complete Fig. 10.1 to show the resistance of each wire.

wire	resistance/ Ω
X	6
Y	
Z	

[2]

Fig. 10.1

(b) Three different resistors, of resistance 2 Ω, 4 Ω and 8 Ω, are connected in series with a 12 V supply as shown in Fig. 10.2.

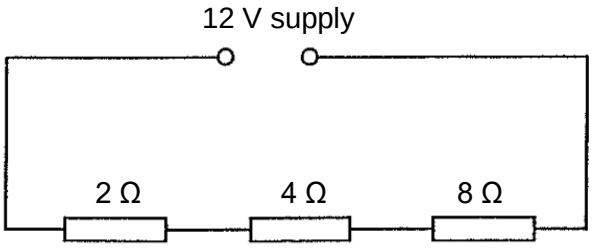

Fig. 10.2

State and explain which resistor has the greatest potential difference across it.

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.....

.....[3]

(c) The resistors in **(b)** are now connected in parallel to a 12 volt supply as shown in Fig. 10.3.

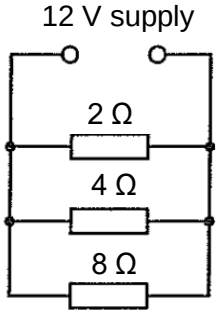

Fig. 10.3

State and explain which resistor will transfer thermal energy at the greatest rate.

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.....

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.....[4]

(d) A student has some resistors, each resistance 10 Ω. In the space below, draw a circuit diagram to show the 10 Ω resistors may be connected to give a total resistance of 15 Ω.

[1]

11 Two metal rods, A and B, of the same size are placed inside a solenoid, as shown in Fig. 11.1. The solenoid is connected to a battery through a switch S.

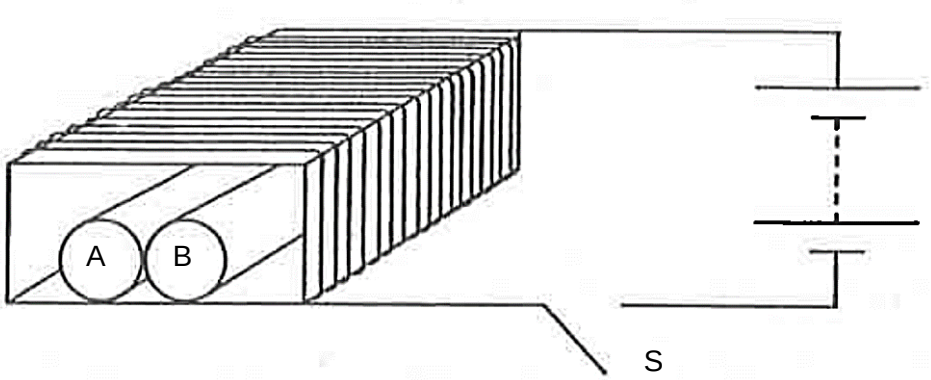

Fig. 11.1

One rod is made of iron, the other of steel.

(a) Explain the following observations that are made with this equipment.

(i) After S is closed, the metal rods roll away from each other.

.....

.....

.....[2]

(ii) After some time, S is then opened. The rods roll towards each other.

.....

.....

.....

.....

.....

.....[3]

(b) Describe and explain what you would expect to observe if the experiments in **(a)** are repeated with a source of low frequency alternating current replacing the battery.

.....

.....

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.....

.....

.....[3]

(c) The rods are removed from the solenoid after carrying out the experiments in **(a)**. Describe and explain how a compass can be used to check whether the rods have been magnetised.

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.....[2]

---End of Paper---