

Write your name here	
Surname	Other names
Pearson Edexcel	Centre Number
Level 3 GCE	Candidate Number
Physics	
Advanced	
Mock Paper - Set 2	Paper Reference 9PH0
You must have: Calculator, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 45.
- The marks for **each** question are shown in brackets
- You may use a scientific calculator.
- For questions marked with an *, marks will be awarded for your ability to structure your answer logically showing the points that you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Show all your working in calculations and include units where appropriate.

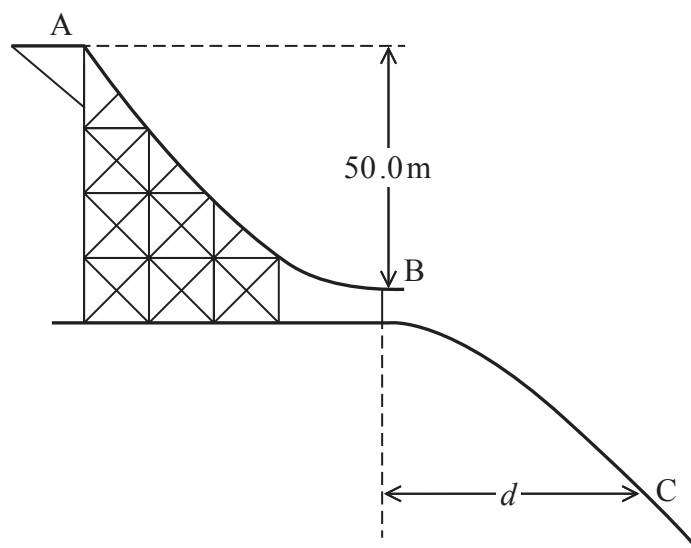
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PEARSON

9BI0/01 - Advanced Physics I

- 1 The diagram shows a ski-jump similar to one used in ski competitions.

The ski jumper starts from rest at A and skis down the slope. The end of the slope at B is 50.0 m vertically below A. When the ski jumper leaves the slope at B he is travelling horizontally. He travels through the air and lands at C which is a horizontal distance d from B.



- (a) Calculate the speed of the ski jumper at B.

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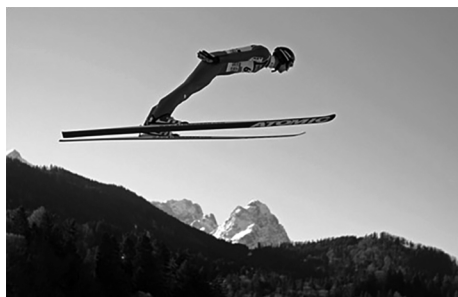
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Speed =

- (b) Add to the diagram the path of the ski jumper after point B.

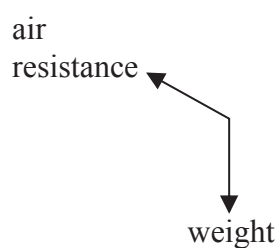
(1)

- *(c) In competitions, the ski jumper aims to achieve a maximum value for d . He achieves this by the position he adopts in the air and using skis manufactured with low density materials.



http://newsimg.bbc.co.uk/media/images/45337000/jpg/_45337660_jump2_ap466.jpg

The free-body force diagram shows the forces acting on the ski jumper in the air.



Explain how the position of the ski jumper in the air and the materials used for the skis can help to increase his horizontal displacement.

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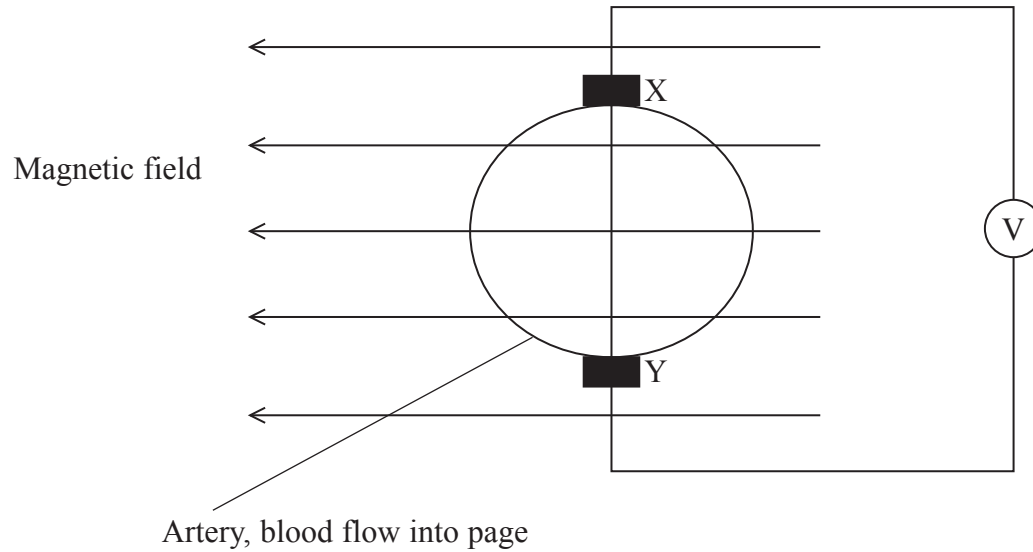
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(Total for Question 1 = 9 marks)

2 An electromagnetic blood flow meter measures the rate of blood flow in an artery.

A uniform magnetic field is applied at right angles to the direction of the blood flow. Electrodes X and Y, connected to a voltmeter, are connected across the artery.



Blood contains negatively charged ions. When the blood flows through the magnetic field the ions are deflected towards one of the electrodes. A reading on the voltmeter is observed.

The deflection of the ions creates a uniform electric field between the electrodes that opposes the force on the ions due to the magnetic field.

When the force on an ion due to the electric field is equal to the force on the ion from the magnetic field, the voltmeter gives a reading of $60\mu\text{V}$.

Calculate the volume of blood that flows through the artery every second.

Magnetic flux density = 0.20 T

Diameter of artery = 4.0 mm

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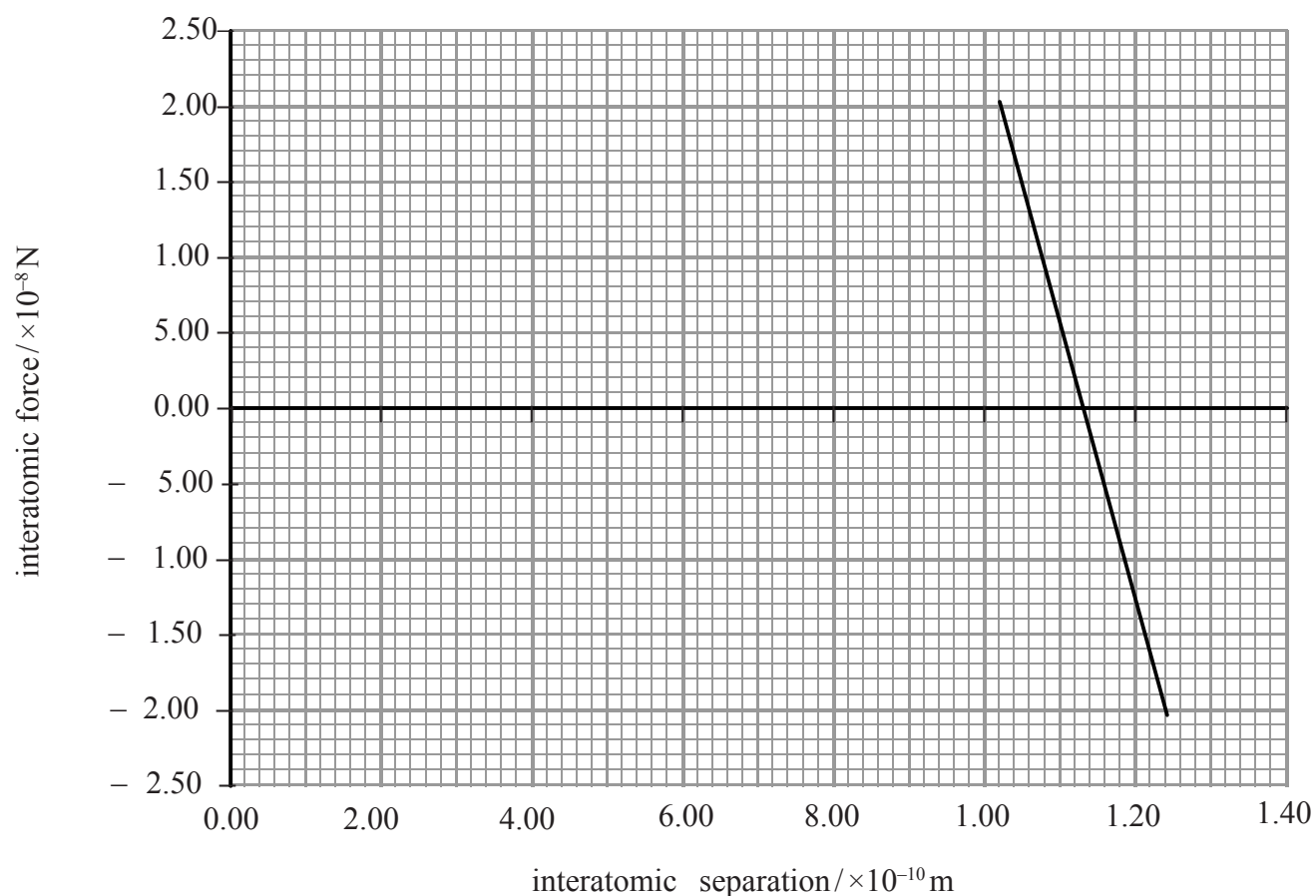
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(Total for Question 2 = 6 marks)

9PH0/02 - Advanced Physics II

- 3 In a catalytic converter, carbon monoxide molecules are absorbed by platinum surface.

The graph shows how the force in the interatomic bond, between a carbon atom and an oxygen atom in a molecule of carbon monoxide, varies over a range of separations of the atoms.



- (a) (i) Explain how the graph shows that the vibration of the atoms in the molecule will be simple harmonic.

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(ii) Show that the force constant for this interatomic bond is about 1900 N m^{-1} .

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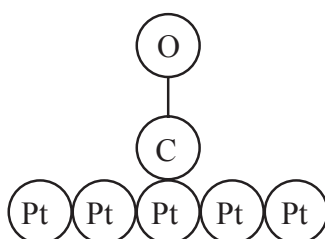
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(iii) When the carbon monoxide molecule is absorbed by the platinum surface, the orientation of the molecule is thought to be as shown, with the carbon atom attached to the platinum surface.



Assuming the carbon atom does not move, determine the natural frequency of oscillation of the oxygen atom.

mass of oxygen atom = $2.66 \times 10^{-26} \text{ kg}$

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Frequency =

(Total for Question 3 = 8 marks)

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4 For a few weeks, type Ia supernovae can have a greater luminosity than the whole of the galaxy containing them, so they can be seen from very large distances and used as standard candles.

*(d) Type Ia supernovae are created when some white dwarf stars gain enough matter from a companion star to explode as a supernova.

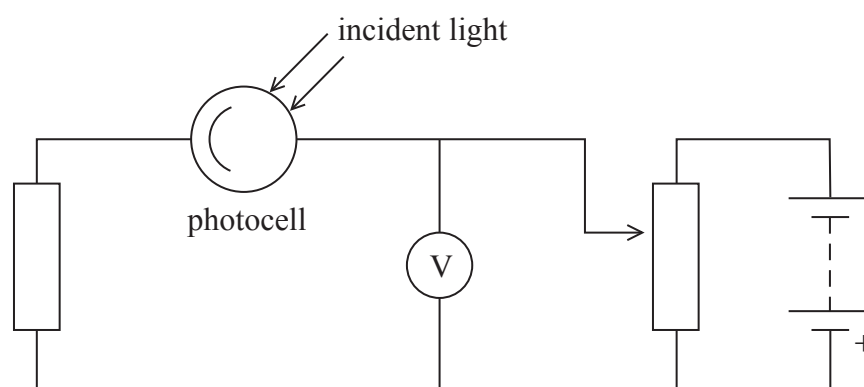
Explain the process by which a star progresses from being a main sequence star to becoming a white dwarf.

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(Total for Question 4 = 6 marks)

9PH0/03 - General and Practical Principles in Physics

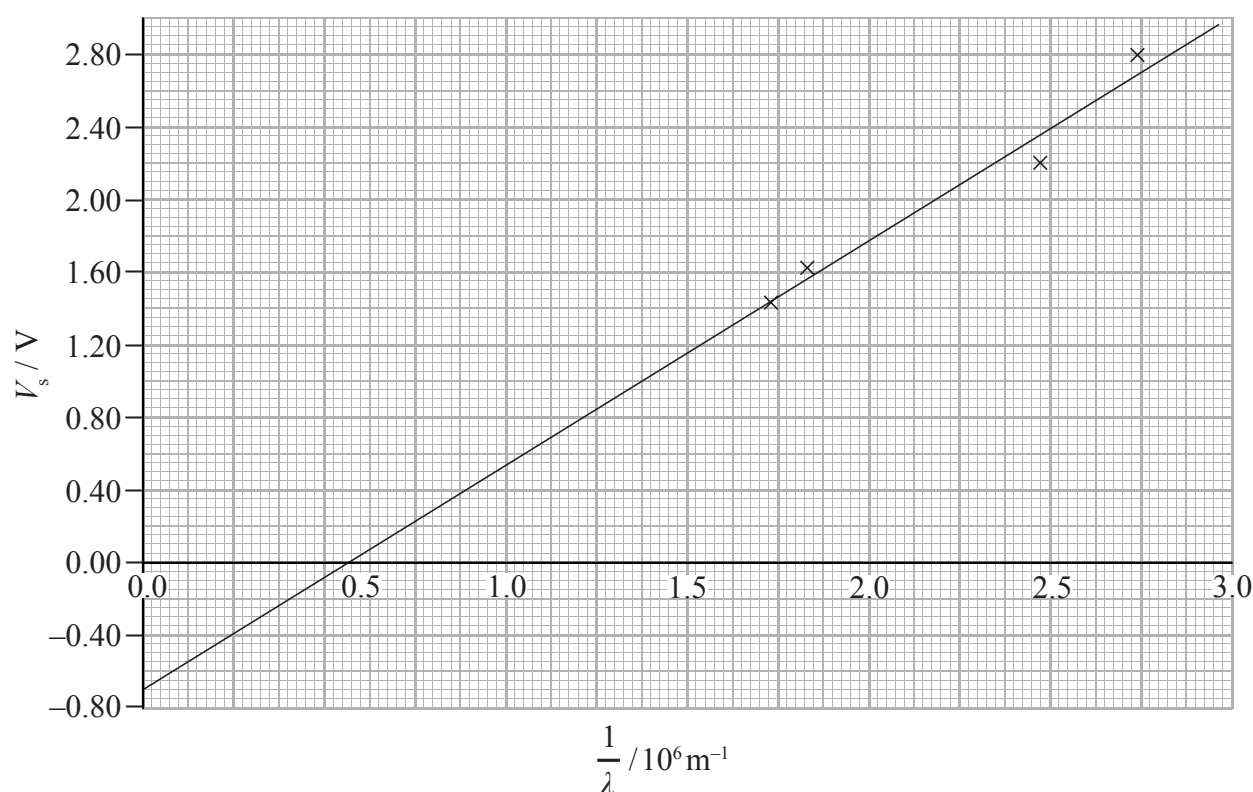
- 5 A student is using a photocell to determine a value for the Planck constant. He illuminates the photocell with light of different wavelengths.



A current flows in the circuit when the photocell is illuminated. For each wavelength λ , the student measures the potential difference V_s which must be applied to reduce the current in the photocell to zero. His readings are shown in the table.

λ / nm	V_s / V	$\frac{1}{\lambda} / \text{m}^{-1}$
365	2.79	2.74×10^6
404	2.20	2.47×10^6
546	1.62	1.83×10^6
577	1.43	1.73×10^6

The student plots a graph of V_s against $\frac{1}{\lambda}$.



The photoelectric equation can be written as

$$\frac{hc}{\lambda} = \phi + eV_s$$

where h is the Planck constant
 c is the speed of light
 ϕ is the work function of the photocathode.

- (a) Use this equation to show that the student should obtain a straight line graph when plotting V_s against $\frac{1}{\lambda}$.

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- (b) Use the student's graph to determine a value for h .

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$h =$

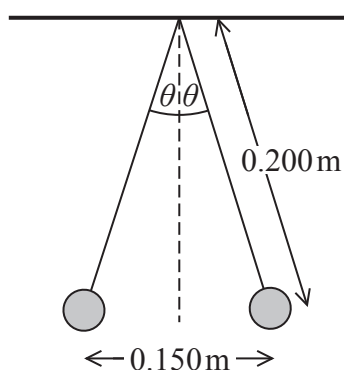
(Total for Question 5 = 6 marks)

- 6 Two small identical conducting spheres are suspended from the same point by insulating threads. The spheres are initially touching as shown in the diagram.



A negatively charged rod is brought near to one sphere and the other sphere is earthed by using a conducting lead to connect the sphere briefly to 0 V.

The spheres spring apart and come to equilibrium when the separation of their centres is 0.150 m.



- (a) (i) Explain why both spheres now carry the same amount of positive charge.

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(Total for Question 6 = 2 marks)

- 7 Helium gas is less dense than air, and so is often used to inflate balloons. A balloon is filled with helium gas at a temperature of 12°C and then tied so that the helium cannot escape.

volume of the balloon = $4.15 \times 10^{-3}\text{m}^3$

pressure of the gas in the balloon = $1.03 \times 10^5\text{Pa}$



If the balloon is released and rises in the atmosphere the pressure exerted by the helium in the balloon decreases. This is because atmospheric air pressure decreases with height above the Earth's surface.

The table shows data collected by a pressure sensor attached to a weather balloon as the weather balloon rises in the atmosphere.

Height of balloon h / m	Atmospheric pressure p / Pa
5000	53 500
10 000	28 700
15 000	15 300
20 000	8 210
25 000	4 390

It is suggested that atmospheric pressure varies according to the expression

$$p = p_0 e^{-Kh}$$

where p_0 is atmospheric pressure at ground level and K is a constant.

Assess the validity of this suggestion by using the data to plot a straight line graph.

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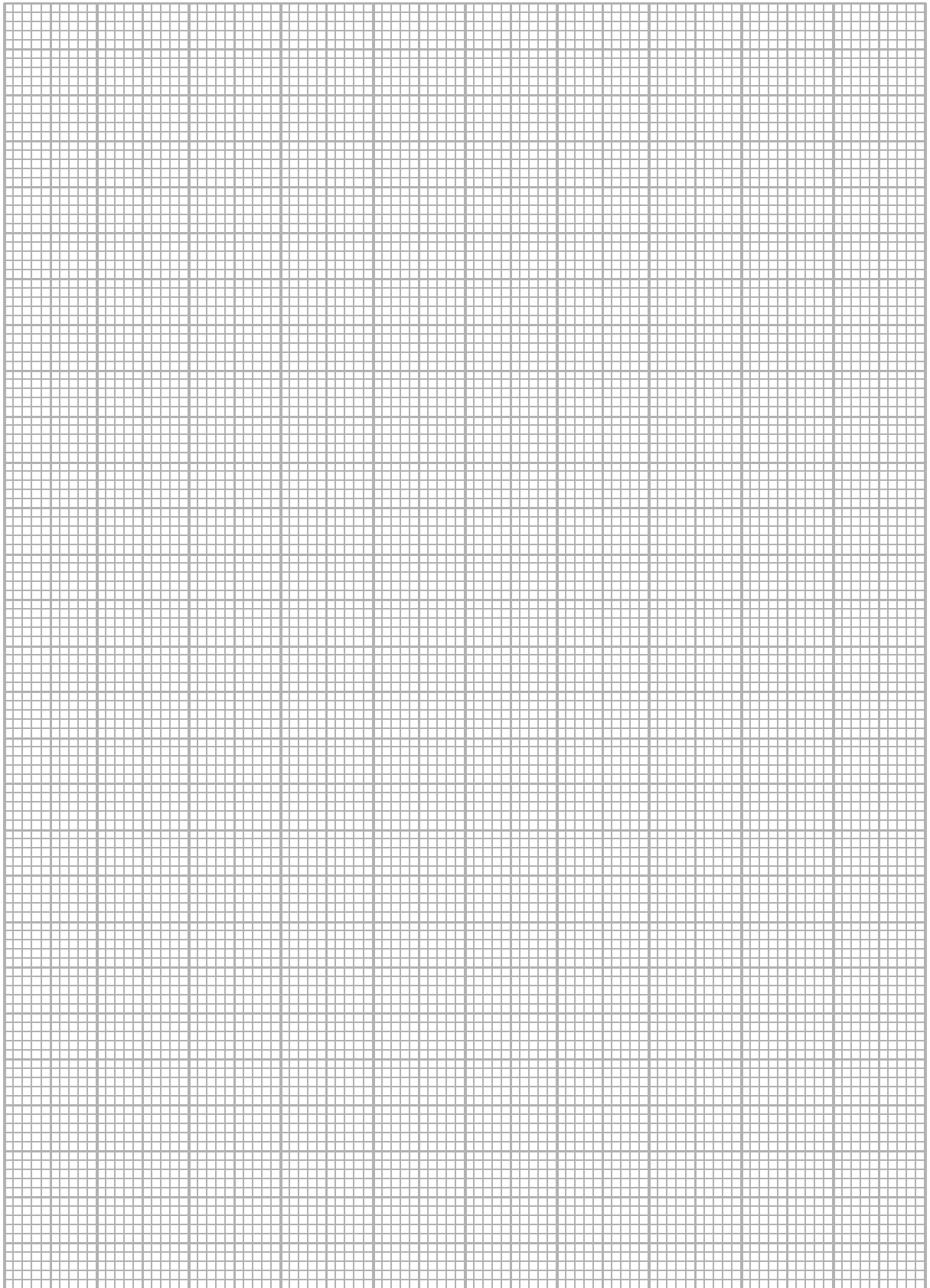
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(Total for Question 7 = 8 marks)