Materials

Question Paper 2

Level	International A Level
Subject	Physics
Exam Board	Edexcel
Topic	Materials
Sub Topic	
Booklet	Question Paper 2

Time Allowed: **48 minutes**

Score: **/40**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 In an experiment to determine the density of a metal a student recorded her final value as 8700 ± 200 kg m^{-3}.

(a) State the range of her measurements.

(1)

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(b) Calculate the percentage uncertainty in her measurement.

(2)

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Percentage uncertainty = ...

(c) The student was given the following table of values.

Metal	**Density / kg m^{-3}**
brass	8440
bronze	8810
copper	8930

State which metal she was using.

(1)

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(Total for Question 1 = 4 marks)

2 A student carried out an experiment to investigate the stretching of a length of rubber of rectangular cross-section. His results are shown below.

original length of rubber = 0.15 m

thickness of rubber = 1.05×10^{-3} m

width of rubber = 2.71×10^{-3} m

Extension / m	Force / N
0	0
0.0225	3.9
0.05	7.9
0.13	9.8
0.235	12.4
0.3	14.0
0.35	18.5

(a) Criticise these results.

(2)

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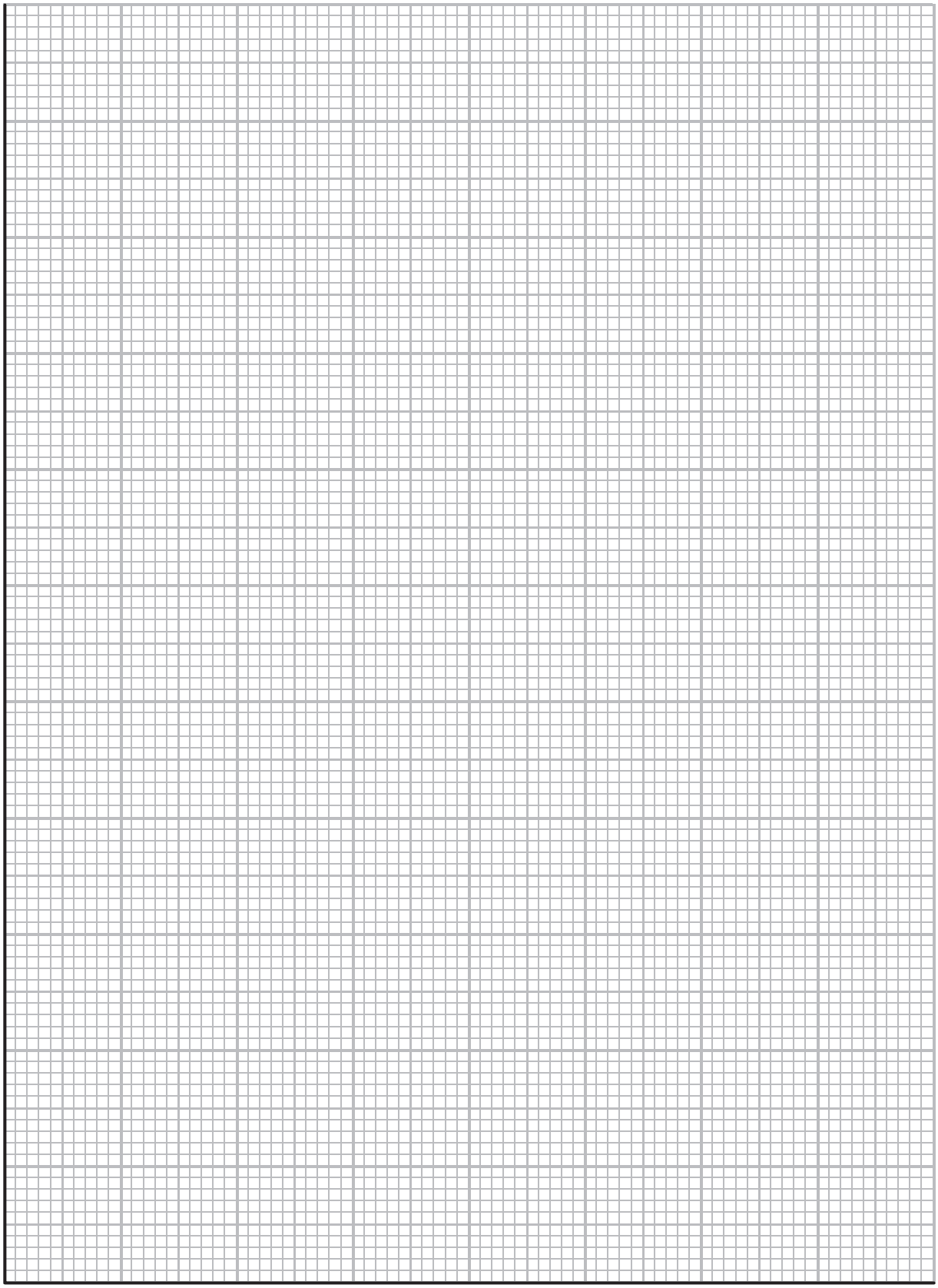
(b) (i) Plot a graph of force on the *y*-axis and extension on the *x*-axis and draw a line of best fit.

(4)



(ii) Comment on the shape of the graph.

(2)

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(iii) The area under the graph represents the work done in stretching the rubber.
Determine the work done in stretching the rubber by 0.2 m.

(4)

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Work done = ...

(c) For the last set of results in the table calculate the stress and strain. State an assumption you have made.

(6)

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Stress = ...

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Strain = ...

Assumption.....

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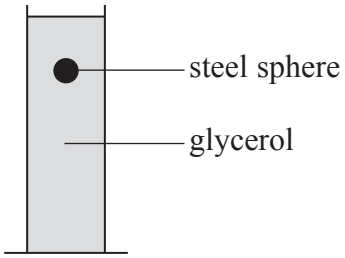
(Total for Question 2 = 18 marks)

3 In an experiment to measure the viscosity η of glycerol, steel spheres are timed falling through a column of glycerol.



The relationship to be used is

$$v = \frac{2r^2 g\left(\rho_s - \rho_g\right)}{9\eta}$$

where v is the terminal velocity of the sphere, r is the radius of the sphere, ρ_s is the density of steel, ρ_g is the density of glycerol and g is the acceleration of free fall.

The results are shown in the table. The radii of the spheres are taken from data provided by the manufacturer.

r / mm	r^2 /	v / m s^{-1}
1	1	0.0098
2	4	0.034
3		0.0781
4	16	0.15

(a) Complete the table with the missing value and unit.

(1)

(b) Criticise these results.

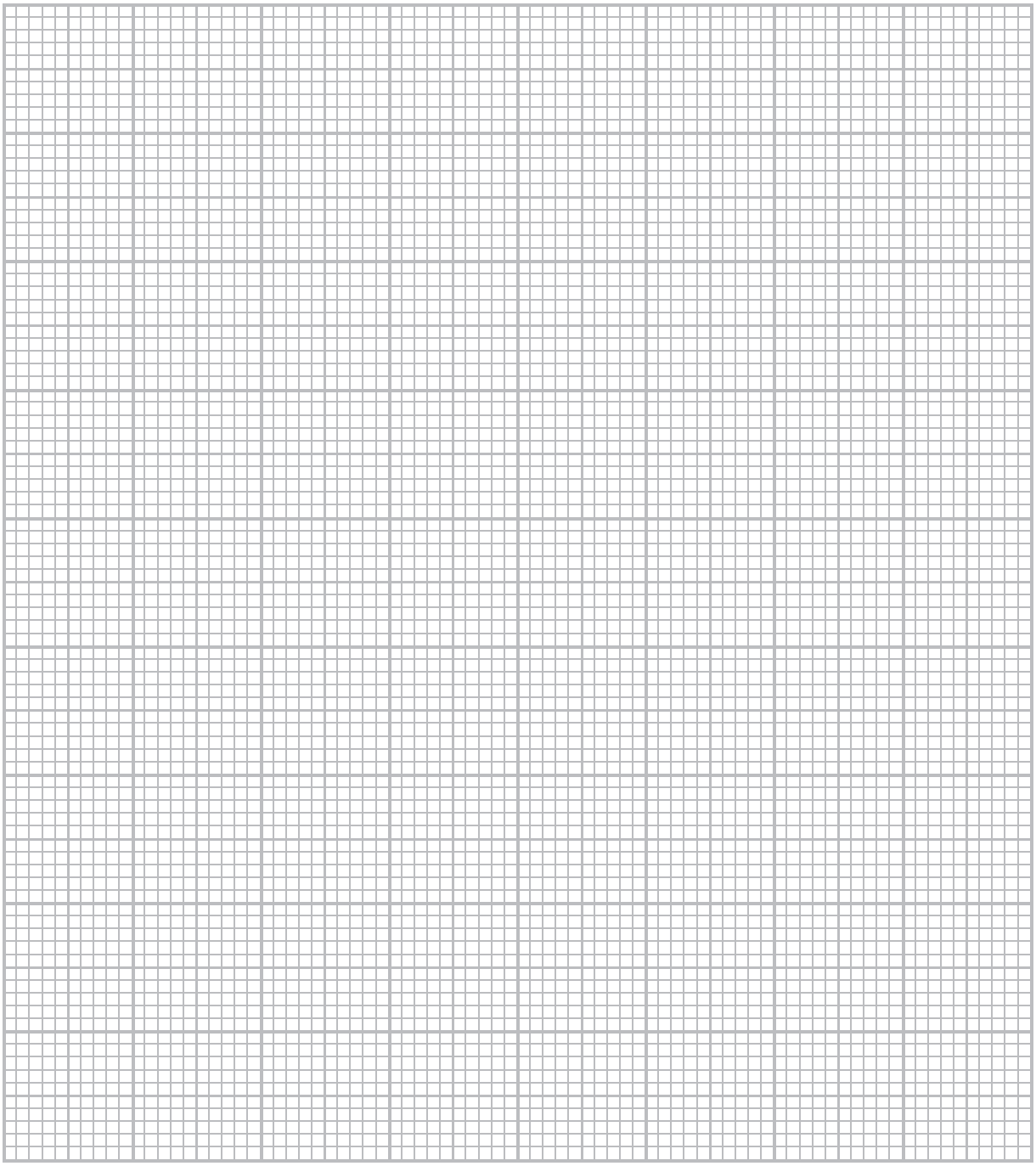
(2)

(c) Explain why a graph of v on the y-axis against r^2 on the x-axis should be a straight line with a gradient of $\frac{2g(\rho_s - \rho_g)}{9\eta}$

(2)

(d) Plot a graph of v on the y-axis against r^2 on the x-axis on the grid provided and draw a line of best fit.

(5)



(e) Use your graph to determine a value for the gradient.

(3)

Gradient = ...

(f) Use your value for the gradient to calculate a value for η.

(3)

$\rho_s = 7800$ kg m^{-3} ρ_g (at room temperature) $= 1200$ kg m^{-3}

η = ...

(g) Suggest **two** factors in the experiment that would affect the value of η.

(2)

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(Total for Question 3 = 18 marks)