

Experimental technique

Question Paper 1

Level	International A Level
Subject	Physics
Exam Board	Edexcel
Topic	Experimental technique
Sub Topic	
Booklet	Question Paper 1

Time Allowed:	52 minutes
Score:	/43
Percentage:	/100

Grade Boundaries:

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

- 1 Light of radiation flux 80 W m^{-2} shines perpendicularly onto a solar heating panel of area 6 m^2 .

In one hour the incident energy is

- A 80 J
- B 480 J
- C 29 000 J
- D 1 700 000 J

(Total for Question 1 = 1 mark)

Questions 2 and 3 refer to the experiment described below.

In an experiment to determine the acceleration of free fall g , a student drops a golf ball from rest. She measures the height from which the ball falls and the time taken to reach the ground.

- 2 The times she records are

0.61 s 0.63 s 0.49 s 0.58 s

Which of the following should she state as the average time?

- A 0.578 s
- B 0.58 s
- C 0.607 s
- D 0.61 s

(Total for Question 2 = 1 mark)

- 3 Which of the following pieces of apparatus would she **not** need to use in this experiment?

- A balance
- B metre rule
- C set square
- D stopwatch

(Total for Question 3 = 1 mark)

4 Four readings are taken of the diameter of a wire:

0.27 mm 0.29 mm 0.72 mm 0.26 mm

Which of the following should be recorded as the mean value?

- A 0.39 mm
- B 0.385 mm
- C 0.273 mm
- D 0.27 mm

(Total for Question 4 = 1 mark)

5 In an experiment to find the resistivity of a wire, the following three measurements of the diameter were recorded.

0.71 mm, 0.72 mm, 0.69 mm

How should the average measurement be stated?

- A $(7.06 \pm 0.13) \times 10^{-3}$ m
- B $(7.1 \pm 0.2) \times 10^{-3}$ m
- C $(7.06 \pm 0.13) \times 10^{-4}$ m
- D $(7.1 \pm 0.2) \times 10^{-4}$ m

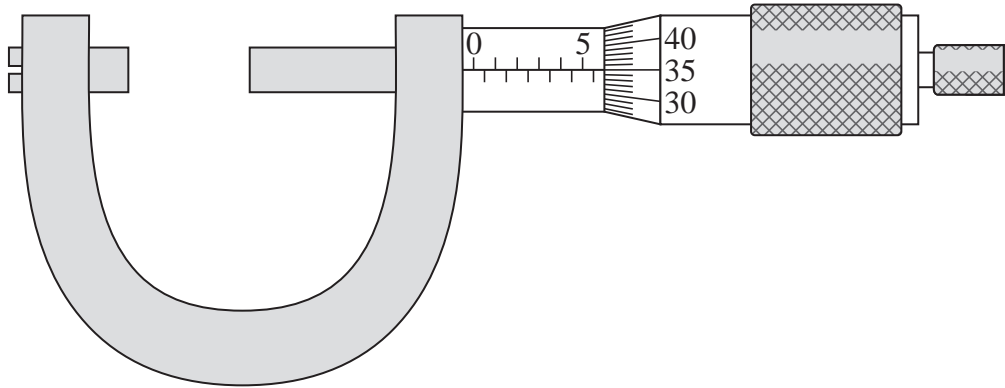
(Total for Question 5 = 1 mark)

6 Which of the following is a base SI unit?

- A ampere
- B newton
- C pascal
- D watt

(Total for Question 6 = 1 mark)

- 7 The diagram below shows a micrometer screw gauge which has been used to measure the width of a piece of metal.

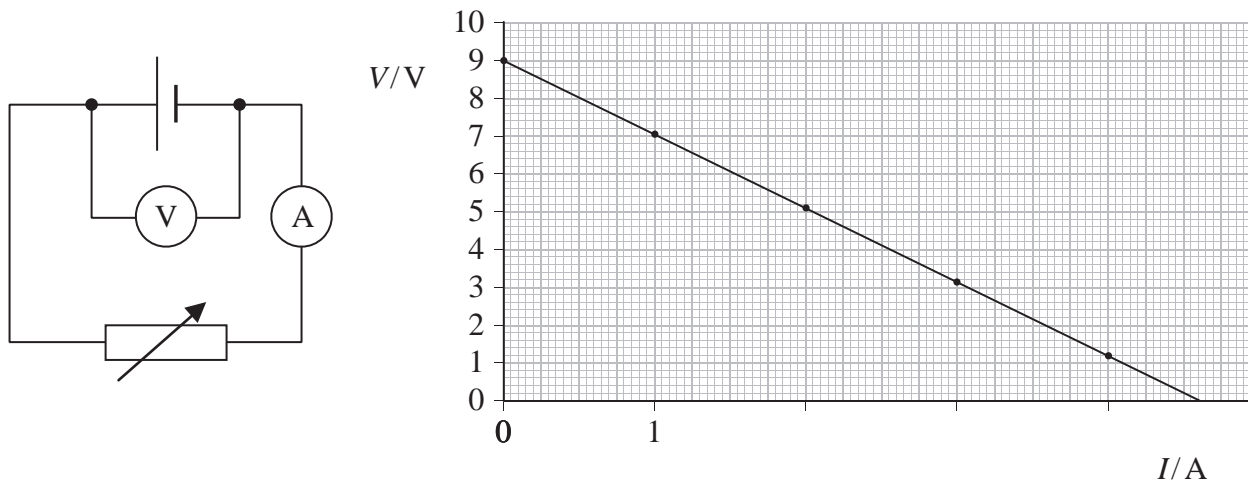


Which is the correct reading of the gauge in millimetres?

- A 5.135
- B 5.235
- C 5.85
- D 6.35

(Total for Question 7 = 1 mark)

Questions 8 and 9 refer to the circuit and graph below. The variable resistor is used to vary the current I and the potential difference V is measured.



8 Which is the correct description of the relationship between V and I ?

- A They are directly proportional.
- B They are inversely proportional.
- C There is a linear relationship.
- D There is a non-linear relationship.

(Total for Question 8 = 1 mark)

9 Which of the following is the magnitude of the gradient of the graph?

- A 2.09
- B 1.96
- C 0.511
- D 0.478

(Total for Question 9 = 1 mark)

10 Which of the following quantities does **not** have a unit?

- A extension
- B pressure
- C strain
- D the Young modulus

(Total for Question 10 = 1 mark)

Use the information below to answer question 11.

In an experiment to measure the acceleration of free fall g , a tennis ball was dropped from rest, four times, from a measured height. The time it took to reach the ground was measured using a stopwatch.

11 The times recorded were:

0.75 s 0.76 s 0.97 s 0.79 s

Which of the following should be recorded as the mean value?

- A 0.767 s
- B 0.77 s
- C 0.817 s
- D 0.82 s

(Total for Question 11 = 1 mark)

12 A student is trying to determine his reaction time. He takes the following readings.

0.21 s, 0.19 s, 0.20 s, 0.09 s

Which of the following is the best mean value of his reaction time stated with a suitable uncertainty?

- A 0.20 ± 0.06 s
- B 0.20 ± 0.01 s
- C 0.17 ± 0.06 s
- D 0.17 ± 0.01 s

(Total for Question 12 = 1 mark)

- 13 Solar lights can be used to illuminate garden pathways during the night. The lights use solar cells that generate electricity during the day to charge a battery. At night the charged battery is used to power a bulb consisting of a light emitting diode (LED).



A solar cell is made up of a semiconductor that produces an electric current when light is incident on it.

- (a) Radiation from the Sun is incident on a solar cell. In order for the solar cell to generate electricity photons with a minimum energy of 2.2 eV are required.

Calculate the maximum wavelength of light required.

(3)

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Maximum wavelength =

- (b) The solar cell has an efficiency of 25%. With the battery initially uncharged, the solar cell is illuminated for 8.0 hours with an average radiation flux of 1300 W m^{-2} . The following night the battery is used to operate the LED bulb.

Calculate the maximum time in hours for which the LED bulb can be operated.

power of LED bulb = 1.5 W

area of solar cell = $3.6 \times 10^{-3} \text{ m}^2$

(4)

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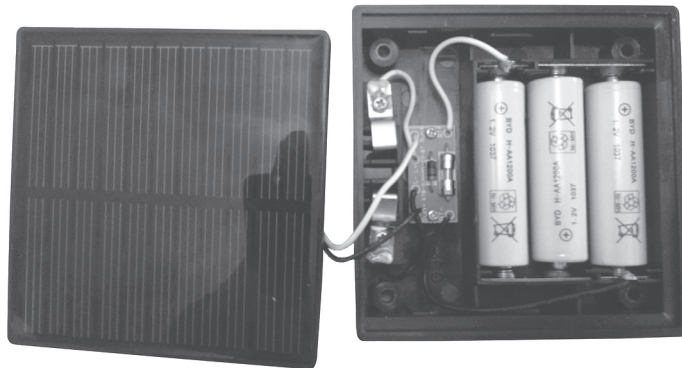
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Maximum time = hours

(Total for Question 13 = 7 marks)

- 14 The photograph shows a solar charging unit consisting of a solar panel connected to three rechargeable cells.



- (a) (i) The radiation flux incident on the solar panel is 49 W m^{-2} . The area of the panel is $6.4 \times 10^{-3} \text{ m}^2$.

Show that the panel receives radiation energy at a rate of about 0.3 W.

(2)

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- (ii) The e.m.f. of the solar panel is 5.6 V.

Calculate the efficiency of the solar panel when the current is 6.8 mA.

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Efficiency =

(b) Each rechargeable cell is marked 1.2 volts, 1500 milliamp hours.

Calculate the maximum energy that can be delivered by the three fully charged cells.

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Maximum energy =

(c) Assuming that the current in the solar cell remains at 6.8 mA, explain whether the three cells would be charged more quickly if connected in series or in parallel.

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(Total for Question 14 = 10 marks)

(b) Describe how you would make the measurement as accurate as possible.

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(Total for Question 15 = 6 marks)

17 A student is planning an experiment to determine the Young modulus for a material in the form of a wire. He plans to hang weights on the wire which is fastened to a support. He carries out a risk assessment using the table below, which has been partly completed.

Complete the table.

(4)

Apparatus	Hazard	Risk	Precaution
Support	topples over	hits experimenter	secure support to bench with G-clamp
Wire			
Hanging weights			

(Total for Question 17 = 4 marks)