

# MARK SCHEME

# GCSE

## PHYSICS

## AQA - TRIPLE SCIENCE

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P3 - TEST 5

PARTICLE MODEL OF MATTER

Advanced

## Mark schemes

1.

(a) any **two** from:

- calculate a mean
- reduces the effect of random errors  
*reduces human error is insufficient*
- identify / remove anomalies  
*allow to assess the repeatability of the data*

2

(b) random error

*allow a parallax error*  
*human error is insufficient*

1

(because) eye position would not be the same each time (relative to the liquid)

*allow systematic error only if it is clear that the student always viewed liquid level from above meniscus (or below)*

1

(c) (a temperature increase would) increase the pressure in the tube  
(even if the volume was constant)

1

(because a higher temperature would mean) higher (average) kinetic energy of molecules / particles

*allow higher (average) speed for higher (average) kinetic energy*

1

(d)  $1.6 \times 10^5 \times 9.0 (= 1.44 \times 10^6)$

1

$$1.44 \times 10^6 = 1.8 \times 10^5 \times V$$

*allow for 2 marks*

$$V = \frac{1.6 \times 10^5 \times 9.0}{1.8 \times 10^5}$$

1

**or**

$$V = \frac{1.44 \times 10^6}{1.8 \times 10^5}$$

$$V = 8.0 \text{ (cm}^3\text{)}$$

1

*an answer of 8.0 (cm<sup>3</sup>) scores 3 marks*

(e) work is done on the air (in the tyre)

1

so the temperature (of the air) increases

*allow the (average) kinetic energy of the particles increases*

1

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2.

**Level 3 (5–6 marks):**

Clear and coherent description of both methods including equation needed to calculate density. Steps are logically ordered and could be followed by someone else to obtain valid results.

**Level 2 (3–4 marks):**

Clear description of one method to measure density **or** partial description of both methods. Steps may not be logically ordered.

**Level 1 (1–2 marks):**

Basic description of measurements needed with no indication of how to use them.

**0 marks:**

No relevant content.

**Indicative content**

**For both:**

- measure mass using a balance
- calculate density using  $\rho = m / V$

**Metal cube:**

- measure length of cube's sides using a ruler
- calculate volume

**Small statue:**

- immerse in water
- measure volume / mass of water displaced
- volume of water displaced = volume of small statue

[6]

3.

(a) conduction

1

(b) 35 000

1

(c) 500

*their (b) = 2 x c x 35 correctly calculated scores 2 marks*

*allow 1 mark for correct substitution,*

*ie 35000 = 2 x c x 35*

**or**

*their (b) = 2 x c x 35*

2

J / kg°C

1

- (d) energy lost to surroundings  
**or**  
 energy needed to warm heater  
*accept there is no insulation (on the copper block)*  
*do **not** accept answers in terms of human error or poor results or defective equipment*

1

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4.

- (i) currents of moving liquids/gases/fluids carrying/transferring energy  
 (can name fluid)

1

- (ii) liquids/gases **expand** when their temperature rises/when they are heated

the **density** of the heated liquid/gas is then **less** than that of the colder liquid/gas which has not been heated

the warmer/less dense liquid/gas **then rises** through the colder/denser liquid/gas

the **colder/denser liquid/gas falls** to replace the liquid/gas which has risen, and in turn becomes heated

*for 1 mark each*

4

[5]

5.

- (a) conduction

1

- (b) (i) there is a bigger temperature difference between the water and the surrounding air

*accept the water is hottest / hotter*

1

so the transfer of energy (from hot water) is faster

*accept heat for energy*

*ignore temperature falls the fastest*

1

- (ii) 120

*allow 1 mark for converting kJ to J correctly, ie 4 032 000*

**or**

correctly calculating temperature fall as 8°C

**or**

allow **2** marks for correct substitution, ie  $4\,032\,000 = m \times 4200 \times 8$

answers of 0.12, 19.2 **or** 16.6 gain **2** marks

answers of 0.019 **or** 0.017 gain **1** mark

3

(iii) water stays hot for longer

1

so heater is on for less time

*accept so less energy needed to heat water*

1

so cost of the jacket is soon recovered from) lower energy costs / bills

*accept short payback time*

1

**[9]**