Past-paper walk-through

Density ▪ 1.4

eXercise

Questions in this set

- 0625/21 N25 Q4 ▪ 1 mark
- 0625/22 N25 Q4 ▪ 1 mark
- 0625/23 N25 Q5 ▪ 1 mark
- 0625/43 N25 Q4 ▪ 9 marks
- 0625/63 N25 Q1 ▪ 11 marks
- 0625/21 J25 Q3 ▪ 1 mark
- 0625/61 J25 Q1 ▪ 11 marks
- 0625/21 J24 Q4 ▪ 1 mark
- 0625/21 N23 Q4 ▪ 1 mark

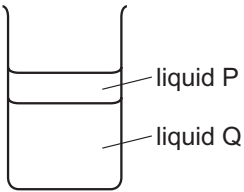
Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 4

0625/21 N25 ▪ Q4 ▪ 1 mark

4 The diagram shows one liquid floating on top of another liquid.



Which statement explains why liquid P floats on top of liquid Q?

A The mass of liquid Q is greater than the mass of liquid P.

Question 4

B The mass of 1 cm^3 of liquid Q is greater than the mass of 1 cm^3 of liquid P.

C The volume of liquid Q is greater than the volume of liquid P.

D The volume of 1 g of liquid Q is greater than the volume of 1 g of liquid P.

Solution 4

Answer: **B**

Why

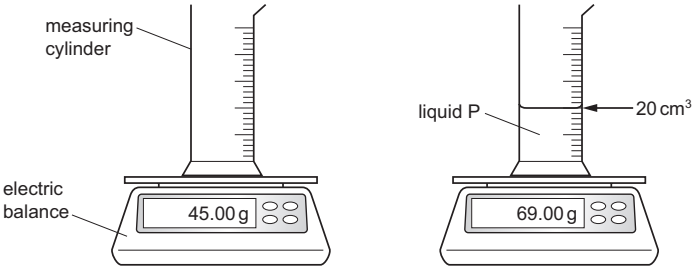
- Whether one liquid floats on another depends on *density*, not on total mass or volume.
- A liquid floats if it is less dense than the one below it.
- So liquid P must have the lower density.

Question 4

0625/22 N25 ▪ Q4 ▪ 1 mark

4 Students are asked to predict the order in which three liquids, P, Q and R, will float on each other. They are told that the liquids will **not** mix.

The diagrams show how the density of liquid P is determined.



Question 4

The table shows the densities of Q and R.

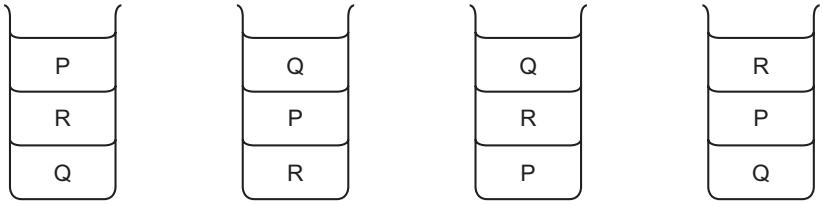
liquid	density / g/cm^3
Q	0.75
R	1.1

The liquids are poured gently into a tall beaker and allowed to settle.

Which diagram shows the liquids settled in the correct order?

A **B** **C** **D**

Question 4



Solution 4

Answer: **C**

Why

- Work out each liquid's density from its mass and its volume.
- The least dense floats on top and the densest sinks to the bottom.
- So rank the three by density and read the order from the top down.

Question 5

0625/23 N25 ▪ Q5 ▪ 1 mark

5 Three different liquids are poured into a tall beaker. The liquids do **not** mix.

The liquid densities are shown in the table.

liquid	density / g/cm^3
P	1.8
Q	2.4
R	1.2

What is the correct order of the liquids from the top of the beaker to the bottom?

Question 5

A $P \to Q \to R$ **B** $Q \to P \to R$ **C** $Q \to R \to P$ **D** $R \to P \to Q$

Solution 5

Answer: **D**

Why

- The least dense liquid floats on top and the densest sinks to the bottom.
- The densities are R 1.2, P 1.8, Q 2.4 g/cm^3.
- So from the top down the order is R, then P, then Q.

Question 4

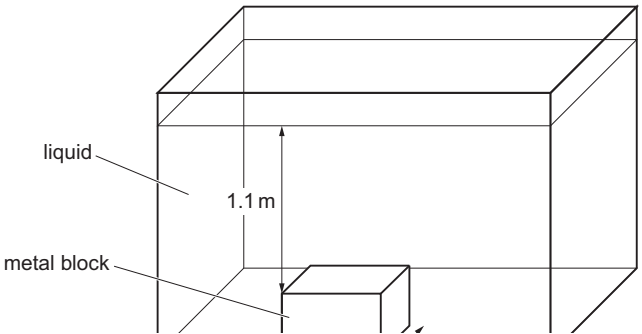
0625/43 N25 ▪ Q4 ▪ 9 marks

4 **(a)** **(i)** A rectangular glass tank contains $3.0\,m^3$ of liquid. The mass of the liquid is 2800 kg. Calculate the density of the liquid.

Question 4

(ii) A metal block is placed in the tank and it sinks to the bottom. The top surface of the block is 1.1 m below the surface of the liquid.

Fig. 4.1 shows the block on the bottom of the tank.



Question 4

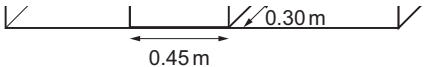


Fig. 4.1

Calculate the force exerted by the liquid on the top of the block.

Question 4

Question 4

(b) Fig. 4.2 shows part of a steel railway track. There are small gaps between sections of the rail.

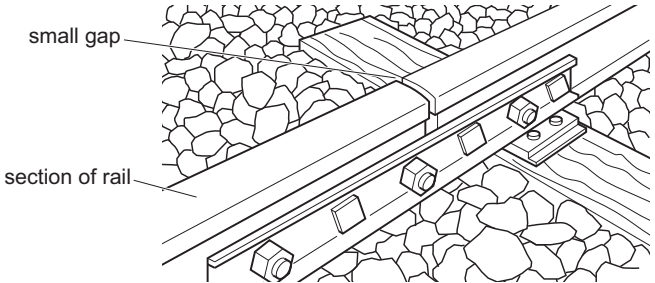


Fig. 4.2

State why gaps are needed between the sections of rail. Explain your answer in terms of particles.

Question 4

particles.

Question 4

Question 4

[2]

(c) Fig. 4.3 shows a saucepan of boiling water on the heating ring of an electric cooker.

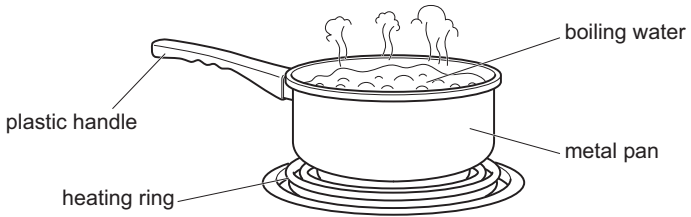


Fig. 4.3

The handle is made from plastic.
Explain why this material is suitable.

Question 4

[Total: 9]

Solution 4

(a)(i)

Mark scheme

- 930 kg / m3

Solution 4

(a)(ii) Mark scheme

- 1400 N
- ( )p = g( )h OR 930 × 9.8 × 1.1 OR 10 000 (N / m2)
- area = length × width OR 0.45 × 0.30 OR 0.14 (m2)
- (F=) p × A OR 10 000 × 0.14
- Alternative method:
- 1400 N
- volume (of liquid above block) = length × width × height OR 0.45 × 0.30 × 1.1 OR 0.15 (m3)

Solution 4

- mass (of liquid above block) = $\times$ v OR 930 $\times$ 0.15 OR 140 (kg)
- (F =) mg OR 140 $\times$ 9.8

Solution 4

(b) Mark scheme

- thermal expansion
- OR to prevent buckling / bending when heated
- any one from:
- ▪
- particles vibrate faster
- ▪
- particles have greater speed / kinetic energy / momentum
- ▪

Solution 4

- vibrations (of particles) take up more space
- ▪
- (average) space / separation between particles increases

Solution 4

(c)

Mark scheme

- (plastic is a good) insulator / poor conductor
- (handle) will not get too hot to touch
- OR reduces heat flow to hand
- 0625/43
- October/November 2025

Question 1

0625/63 N25 ▪ Q1 ▪ 11 marks

1 A student determines the volume of a block of modelling clay by two methods.

Method 1

He measures the block of modelling clay shown full size in Fig. 1.1.

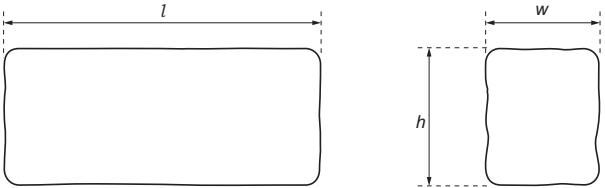


Fig. 1.1

Question 1

(a) **(i)** Measure the length l, width w and height h of the block of modelling clay on Fig. 1.1. Record your values in centimetres to the nearest millimetre.

Question 1

Question 1

Question 1

[2]

(ii) Calculate a value V_A for the volume of the block. Use your measurements from **(a)(i)** and the equation:

$$V_A = l \times w \times h.$$

Question 1

(b) Suggest why V_A is only an approximate value for the volume of the block.

Describe how the accuracy of V_A can be improved.

Question 1

Question 1

Question 1

Question 1

[2]

(c) Another student measures the dimensions of a block of clay which is much smaller than the block in **(a)**. Suggest why these measurements may not be as accurate as yours, even if they are done carefully.

Question 1

Method 2

(d) (i) The student pours water into a measuring cylinder.

Record the volume V_1 of the water in the measuring cylinder shown in Fig. 1.2.

Question 1

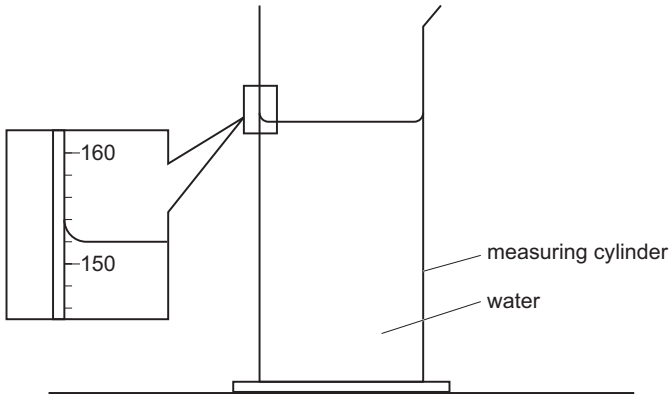


Fig. 1.2

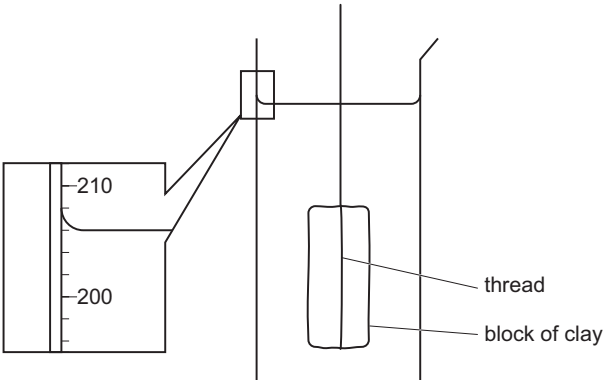
Question 1

Question 1

(ii) Describe briefly how a measuring cylinder is read to obtain an accurate value for the volume of water.

Question 1

(e) The student lowers the modelling clay into the water using a loop of thread, as shown in Fig. 1.3.



Question 1

Question 1

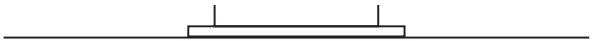


Fig. 1.3

Record the new reading V_2 shown on the measuring cylinder scale in Fig.1.3.

Question 1

Calculate another value V_B for the volume of the block.

Use your measurements from **(d)(i)** and **(e)** and the equation: $V_B = (V_2 - V_1)$.

Question 1

[1]

(f) Suggest **one** possible source of inaccuracy in Method 2 and suggest **one** improvement to reduce its effect.

Question 1

Question 1

Question 1

Question 1

[2]

[Total: 11]

Solution 1

(a)(i)

Mark scheme

- l $= 6.9\,(\text{cm})$ w $= 2.5\,(\text{cm})$ h $= 3.0\,(\text{cm})$
- all to nearest mm
- 2

Solution 1

(a)(ii)

Mark scheme

- VA = 52 (cm3)
- 1

Solution 1

(b)

Mark scheme

- irregular dimensions / owtte
- repeat in several places (for each dimension) and take averages
- 2

Solution 1

(c)

Mark scheme

- effect of uncertainties increased/
- larger % uncertainty/owtte
- 1

Solution 1

(d)(i)

Mark scheme

- V1 = 152 (cm3)
- 1

(d)(ii)

Mark scheme

- line of sight perpendicular / owtte
- 1

Solution 1

(e)

Mark scheme

- V2 present and VB = V2 -V1

Solution 1

(f) Mark scheme

- suitable source of inaccuracy
- e.g. graduations on measuring cylinder too large /
- thread affects volume / cylinder is wide / clay may absorb water
- matching improvement
- e.g. use smaller measuring cylinder / more precise scale / thinner thread / no thread and place carefully / measure volume of
- thread / narrower cylinder / cover clay with paint or cling film
- 2

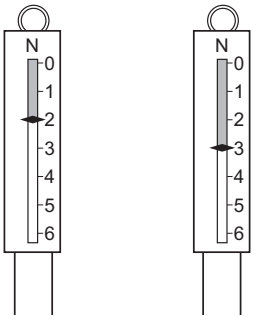
Solution 1

- 0625/63
- October/November 2025

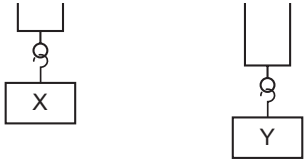
Question 3

0625/21 J25 ▪ Q3 ▪ 1 mark

3 The diagrams show two metal blocks, X and Y, suspended from identical force meters. X and Y have identical dimensions.



Question 3



Which statement about X and Y is correct?

A They have different volumes and different weights.

B They have different volumes and equal weights.

C They have equal volumes and equal weights.

D They have equal volumes and different weights.

Solution 3

Answer: **D**

Why

- Identical dimensions means the two blocks have identical volume.
- Different force-meter readings mean different weights, so different masses.
- Same volume with different mass means different density – the heavier block is the denser one.

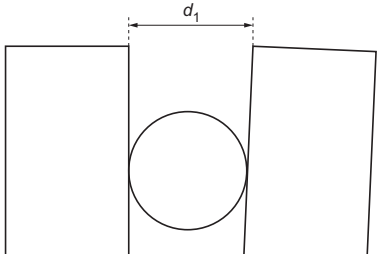
Question 1

0625/61 J25 ▪ Q1 ▪ 11 marks

1 A student determines the density of a ball.

(a) He places the ball between two wooden blocks, as seen from above in Fig. 1.1.

He takes two measurements, d_1 and d_2.



Question 1

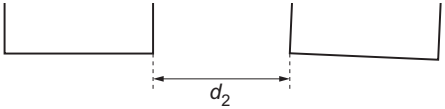


Fig. 1.1

(i) On Fig. 1.1, measure the lengths d_1 and d_2.

Question 1

Question 1

[1]

(ii) Using your measurements, calculate the diameter *d* of the ball. Show your working.

Question 1

(iii) Explain why this method is used to measure the diameter of the ball.

Question 1

(b) Calculate the volume V of the ball using the equation $V = 0.52d^3$.

Include the unit.

Question 1

(c) The student measures the mass m_D of a dish.

103.5

Question 1

He places the ball in the dish and measures the combined mass m_C of the dish and the ball.

Fig. 1.2 shows the dish and the ball on a balance.

Record the reading shown on the balance.

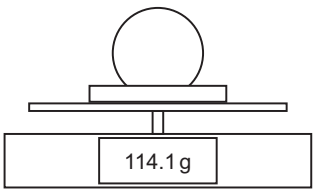


Fig. 1.2

Question 1

Calculate the mass m_B of the ball. Show your working.

Question 1

[2]

(d) Calculate the density ρ of the ball using the equation:

$$\rho = \frac{m_B}{V}.$$

Give your answer to a suitable number of significant figures for this experiment. Include the unit.

Question 1

[Total: 11]

Solution 1

(a)(i)

Mark scheme

- two measurements in cm 2.7 and 2.5, both given to nearest mm
- 1

(a)(ii)

Mark scheme

- correct average: expect 2.6 (cm)
- 1

Solution 1

(a)(iii)

Mark scheme

- any reasonable advantage for the method in the question given OR it is difficult to measure the diameter directly OR hard to
- find centre of ball
- 1
- a ruler for measuring the diameter directly would give rise to parallax errors
- 1

Solution 1

(b)

Mark scheme

- V = 9.1(4)
- 1
- unit: cm3
- 1

Solution 1

(c)

Mark scheme

- correct method for calculation of mB shown
- 1
- $\text{mB} = 11.6\,(\text{g})$
- 1

Solution 1

(d) Mark scheme

- on answer line correctly calculated to 2 or more significant figures
- 1
- unit: g / cm3
- 1
- answer given to 2 or 3 significant figures
- 1
- 0625/61
- May/June 2025

Question 4

0625/21 J24 ▪ Q4 ▪ 1 mark

4 The mass of an object is 2.5 kg. The volume of the object is 480 cm^3.

What is the density of the object?

A $5.2 \times 10^{-3}\,g/cm^3$

B $5.2\,g/cm^3$

C $190\,g/cm^3$

D $1.2 \times 10^{3}\,g/cm^3$

Solution 4

Answer: **B**

Why

- Convert to matching units first: 2.5 kg $= 2500$ g.
- $\rho = m/V = 2500/480$.
- $= 5.2$ g/cm^3.

Question 4

0625/21 N23 ▪ Q4 ▪ 1 mark

4 The table shows the mass and volume of three different liquids, X, Y and Z.

liquid	mass / g	volume / cm^3
X	120	200
Y	80	67
Z	100	120

The liquids are placed in the same container. The liquids do not mix.

Which liquid is at the top of the container and which liquid is at the bottom?

Question 4

	liquid at top	liquid at bottom
A	X	Y
B	X	Z
C	Y	X
D	Y	Z

Solution 4

Answer: **A**

Why

- Density is mass divided by volume: X $= 120/200 = 0.60$, Y $= 80/67 = 1.2$, Z $= 100/120 = 0.83$ g/cm^3.
- The least dense liquid floats on top and the densest sinks to the bottom.
- So from the top down the order is X, then Z, then Y.