# Mark scheme

## Measuring density

Physics 0625 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

**86**

**MARKS FOR EACH QUESTION**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 6 | 7 | 8 | 8 | 8 | 10 | 11 | 11 | 11 | **86** |

### Question 1 [6]

**1** **(a)** 8 or 8.0 (cm) B1

**(b)** $8 \times 4 \times 0.5$ e.c.f. from (a) C1
16 ($cm^3$) e.c.f. A1

**(c)** **(i)** $D = M / V$ in any form OR $V \times D$ OR his volume × 1.2 C1
19.2 (g) e.c.f. A1

**(ii)** balance (accept spring balance)
OR scales NOT scale B1

[6]

### Question 2 [6]

| | | |
|---|---|---|
| 2(a) | find mass of measuring cylinder / beaker / container empty | **B1** |
| | add sea water AND read volume | **B1** |
| | find mass of measuring cylinder / beaker / container with seawater | **B1** |
| | subtract the 2 mass readings (to give mass of seawater) | **B1** |
| | (D) = M ÷ V in any form | **B1** |
| 2(b) | wood less dense (than seawater) / ora | **B1** |

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## Question 3 [7]

**3** **(a)** d = m / V in any form OR (V =) m / d OR 200 / 8.4 C1
$24\ cm^3$ A1

**(b)** **(i)** density less (than water) OR upthrust ≥ weight B1

**(ii)** determine any volume of any liquid ($V_1$) B1
states viable method to submerge wood B1
reads volume ($V_2$) from previous line and determines volume of (wood + brass) ($V_2 - V_1$) B1
subtract volume of brass from above (to give volume of wood) B1

**[Total: 7]**

## Question 4 [8]

| | | |
|---|---|---|
| 4(a) | (A =) lead, (B=) iron, (C=) aluminium | **B1** |
| 4(b) | density = mass ÷ volume in any form (V =) M/d | **C1** |
| | 200 ÷ 8.4 | **C1** |
| | 24 ($cm^3$) | **A1** |
| 4(c) | add water to measuring cylinder/note the volume of water added | **B1** |
| | lower/immerse metal object into water | **B1** |
| | note new volume of water owtte | **B1** |
| | subtract new volume from initial volume/determine difference in volumes | **B1** |

## Question 5 [8]

| | | |
|---|---|---|
| 5(a) | (volume =) 48 ($cm^3$) | **A2** |
| | (volume =) l × b × h | **(C1)** |
| 5(b)(i) | 11 (g / $cm^3$) | **A2** |
| | (density =) 86 ÷ 8.0 | **(C1)** |
| 5(b)(ii) | any value greater than **(b)(i)** (g / $cm^3$) | **B1** |
| 5(c) | any **three** from:<br>measure mass of (empty) measuring cylinder on balance<br>add liquid to measuring cylinder **AND** read volume<br>measure mass of measuring cylinder **AND** liquid on balance<br>find difference in the 2 mass readings | **B3** |

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## Question 6 [8]

| | | |
|---|---|---|
| **6**(a) | any **three** from:<br>• measuring cylinder (part) filled with water<br>• volume of water measured or recorded/noted/read<br>• metal submerged / placed in water owtte<br>• new volume read / noted / measured / recorded | **B3** |
| | volume of metal = difference in volumes | **B1** |
| **6**(b) | ($\rho$ =) 6 | **A3** |
| | ($\rho$ =) 192 ÷ 30 | (C2) |
| | (density =) mass ÷ volume **OR** ($\rho$ =) $m$ / $V$ in any form | (C1) |
| | g / cm$^3$ | **B1** |

## Question 7 [10]

**7** **(a)(i)(ii)** $m_1 = 40.68$ (g) and $m_2 = 113.60$ (g)
correct answer only (not 40:68, 113:60) [1]

**(iii)** $V_1 = 72$ (cm$^3$) correct answer only [1]

**(iv)** $\rho_1$ with unit of g / cm$^3$ or kg / m$^3$ seen in **(a)**, **(b)** or **(c)** and not contradicted
(unit must match value) [1]

**(b)(i)(ii)** $m_3 = 15.47$ (g) and $V_2 = 88$ (cm$^3$) correct answer only [1]

**(iii)** $V_3 = 16$ (cm$^3$) / ecf [1]

**(iv)** $\rho_2$ to 2 / 3 sig. figs. [1]

**(c)** $\rho_{AV}$ 0.99(1) (g / cm$^3$) **or** 991 / 990 (kg / m$^3$) **or** ecf from **(a)** and **(b)** [1]

**(d)** any one from:
- take reading perpendicularly / at right angles to scale
- read bottom of meniscus
- other suitable precaution [1]

**(e)** appropriate source of inaccuracy, other than in **(d)**
e.g. balance not at zero / test-tube catches on side of measuring cylinder [1]

matching effect on $\rho$ with explanation
e.g. $\rho$ greater as mass reading larger / $\rho$ greater as volume smaller [1]

**[Total: 10]**

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## Question 8 [11]

**8** **(a)** **(i)** 34 ($cm^3$) C1
42 ($cm^3$) C1
8 ($cm^3$) A1

**(ii)** **1.** balance (accept spring balance) OR newtonmeter
OR scales NOT scale B1
**2.** $D = M/V$ in any form C1
21.2 / his 8 C1
2.65 e.c.f. A1
g / $cm^3$ B1

**(b)** **(i)** rule(r) OR vernier/digital calipers IGNORE just calipers B1

**(ii)** measure diameter / radius / c.s.a. B1
use cylinder formula (need not be quoted) to calculate B1
OR
measure mass B1
use density from (a) in $V = M / D$ B1 [11]

## Question 9 [11]

| | | |
|---|---|---|
| **9**(a)(i) | $l$ = 5.1 (cm) and $w$ = 4.7 (cm) | **1** |
| **9**(a)(ii) | $V$ = 95.88 ($cm^3$) | **1** |
| **9**(a)(iii) | 64 (g) | **1** |
| **9**(a)(iv) | $\rho$ to 2 or 3 significant figures | **1** |
| | unit g / $cm^3$ | **1** |
| **9**(b)(i) | estimate of $V_1$ given to the nearest $cm^3$ and > ½$V$ < $V$ | **1** |
| **9**(b)(ii) | $m_W$ numerically equal to $V_1$ | **1** |
| **9**(c)(i) | $d$ = candidate's **(a)(iii) – (b)(ii)** correct | **1** |
| **9**(c)(ii) | YES/NO and suitable comparison of $d$ with $m$ or $m_W$ | **1** |
| **9**(d) | (float wood and) mark water level / remove and mark the water level | **1** |
| | measure submerged depth and multiply by the cross-sectional area | **1** |
| | OR | |
| | measure height of block that is not submerged | (1) |
| | multiply by the cross-sectional area then subtract from total volume of block. | (1) |
| | OR | |
| | use of a measuring cylinder / displacement can | (1) |
| | measure the volume of water displaced (by the floating block) | (1) |

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## Question 10 [11]

| | | |
|---|---|---|
| **10**(a)(i) | two measurements in cm 2.7 and 2.5, both given to nearest mm | **1** |
| **10**(a)(ii) | correct average: expect 2.6 (cm) | **1** |
| **10**(a)(iii) | 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** |
| **10**(b) | $V$ = 9.1(4) | **1** |
| | unit: $cm^3$ | **1** |
| **10**(c) | correct **method** for calculation of $m_B$ shown | **1** |
| | $m_B$ = 11.6 (g) | **1** |
| **10**(d) | $\rho$ on answer line correctly calculated to 2 or more significant figures | **1** |
| | unit: $g / cm^3$ | **1** |
| | answer given to 2 or 3 significant figures | **1** |

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