# 1. Motion, forces and energy

## 1.1 Physical quantities and measurement techniques

## Paper 3 and 4

Answer Key

# Paper 3

Q1.

| Question | Answer | Marks |
|---|---|---|
| (a) | measure the width of n loops with rule | B1 |
| | n =10 or more loops | B1 |
| | (diameter of one loop) = total width ÷ n if n > 1 | B1 |

Q2.

| Question | Answer | Marks |
|---|---|---|
| (a) | (average thickness =) 0.9 (cm) | A2 |
| | (average thickness =) 5.4 ÷ 6 | (C1) |
| (b) | any **two** from:<br>• (measuring) cylinder (partially) filled with water<br>• (initial) volume of water (in measuring cylinder) measured or recorded / noted / read<br>• mass(es) in water **OR** water covers all mass(es)<br>• new volume measured or recorded / noted / read | B2 |
| | difference between two values (of water with and without masses is determined) | B1 |

Q3.

| Question | Answer | Marks |
|---|---|---|
| (a)(i) | 4.3 (cm) | A2 |
| | 5.8 (– 1.5) | C1 |
| (a)(ii) | **(a)(i)** ÷ 8 correctly evaluated (0.54 (cm) if 4.3 cm used) | A2 |
| | **(a)(i)** ÷ 8 | (C1) |

Q4.

| Question | Answer | Marks |
|---|---|---|
| (a) | 21 ($cm^3$) | **B1** |
| (b) | 0.2(0) ($cm^3$) | **A4** |
| | (average volume of one drop) = 4(.0) / 20 | C3 |
| | (volume = 25 – 21 =) 4(.0) ($cm^3$) | C1 |
| | total volume = number of drops × (average) volume of one drop | C1 |
| (c) | any **four** from:<br>• measure volume of water (in a measuring cylinder)<br>• add metal to water in the measuring cylinder<br>• so that metal is completely submerged<br>• measure (new) volume of water in a measuring cylinder (with metal)<br>• find the difference between the two volumes. | **B4** |

Q5.

| Question | Answer | Marks |
|---|---|---|
| (a)(i) | 0.3(0) ($cm^3$) | **A3** |
| | (average volume of one drop) = 60 ÷ 200 | **(C2)** |
| | total volume = number of drops × (average) volume of one drop | **(C1)** |
| (a)(ii) | 226.5 (s) | **A2** |
| | 180 (+ 46.5 =) | **(C1)** |
| (a)(iii) | 1.1 (s) | **A2** |
| | time for one drop = total time ÷ no of intervals | **(C1)** |
| (b) | 84 ($cm^3$) | **B1** |

Q6.

| Question | Answer | Marks |
|---|---|---|
| (a) | 1.6 (cm) OR 14.8 (cm) seen OR used | **C1** |
| | 13.2 (cm) | **A1** |
| (b)(i) | (top pan / chemical / beam) balance | **B1** |
| (b)(ii) | 22 ($cm^3$) OR 18 ($cm^3$) seen OR used | **C1** |
| | 4(.0) ($cm^3$) | **A1** |
| (c) | (density = ) mass ÷ volume OR ( d =) m ÷ v in any form | **C1** |
| | 93.6 ÷ 12 | **C1** |
| | 7.8 (g / $cm^3$) | **A1** |

Q7.

| Question | Answer | Marks |
|---|---|---|
| (a)(i) | (average thickness =) 3.8 ÷ 20 | C1 |
| | (average thickness =) 0.19 (cm) (which is about 0.2 cm) | A1 |
| (a)(ii) | any **one** from:<br>wire(s) not touching OR wire stretched (in places) OR ruler not at zero (owtte) OR wire(s) overlapping OR eye not directly above ruler (owtte) | B1 |
| (b) | density = mass ÷ volume OR $\rho = \frac{m}{V}$ in any form. | C1 |
| | ($\rho$ =) 148 ÷ 16.6 | C1 |
| | ($\rho$ =) 8.9 (g / cm$^3$) | A1 |
| (c) | measuring cylinder partially filled with water<br>coil submerged in water (owtte)<br>new volume noted<br>volume of wire = difference or increase in volume(s) | B4 |

Q8.

| Question | Answer | Marks |
|---|---|---|
| (a) | (time =) 20 ÷ 50 | C1 |
| | 0.4 (s) | A1 |
| (b)(i) | measuring cylinder | B1 |
| (b)(ii) | W = m x g | C1 |
| | (W =) 0.21 × 10 | C1 |
| | 2.1 (N) | A1 |

Q9.

| Question | Answer | Marks |
|---|---|---|
| (a) | (student) S | B1 |
| (b) | 83.37 (s) seen | C1 |
| | 83.37 ÷ 50 | C1 |
| | 1.67 (s) cao | A1 |
| (c) | 165 (mm) | B1 |

Q10.

| Question | Answer | Marks |
|---|---|---|
| (a) | 67 (cm) | C1 |
| | (67 ÷ 5 =) 13.4 (cm) | A1 |
| (b) | C 1st ; A 2nd; | B1 |
| | D 4th; E 5th | B1 |
| (c) | speed = distance ÷ time in any form OR (t = ) distance ÷ speed | C1 |
| | 11 ÷ 16 | C1 |
| | 0.69 (s) | A1 |

# Paper 4

Q11.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>(use stop-watch to) time oscillations</td><td>B1</td></tr>
<tr><td></td><td>(use of fiduciary) aid to determine a complete cycle</td><td>B1</td></tr>
<tr><td></td><td>(use of) multiple oscillations AND division (to determine period)</td><td>B1</td></tr>
<tr><td>(b)</td><td><table><tr><td>quantity</td><td>device</td></tr><tr><td>volume of water in a glass</td><td>measuring cylinder</td></tr><tr><td>width of a small swimming pool</td><td>metre rule</td></tr><tr><td>thickness of a piece of aluminium foil</td><td>micrometer screw gauge</td></tr></table>1 mark for each correct response</td><td>B3</td></tr>
</table>

Q12.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>it / a vector has a direction</td><td>B1</td></tr>
<tr><td>(b)</td><td>two / three vectors and no more than one other quantity underlined</td><td>C1</td></tr>
<tr><td></td><td>acceleration and momentum and velocity underlined and no others</td><td>A1</td></tr>
</table>