

MS P2

Q1. W23 QP 23 Q1

| Question | Answer | Marks |
|-----------|---|-----------|
| 1(a) | charge and power only ticked | B1 |
| 1(b)(i) | %D = 0.4% and %L = 0.6% | A1 |
| 1(b)(ii) | $\rho = (4 \times 0.247) / [\pi \times (26.2 \times 10^{-3})^2 \times 0.162]$ | C1 |
| | $\rho = 2.83 \times 10^3 \text{ kg m}^{-3}$ | A1 |
| 1(b)(iii) | percentage uncertainty = $0.4 + (2 \times 0.4) + 0.6$ | C1 |
| | = 1.8% | A1 |

S24 QP 23 Q1(a)

| Question | Answer | Marks |
|----------|--|-----------|
| 1(a) | units of F : kg m s^{-2} | C1 |
| | units of r : m and units of v : m s^{-1} | A1 |
| | units of η : $\text{kg m s}^{-2} / (\text{m} \times \text{m s}^{-1}) = \text{kg m}^{-1} \text{ s}^{-1}$ | |

Q2. S24 QP 23 Q2

| Question | Answer | Marks |
|-----------|--|-----------|
| 2(a) | distance (from the point) in a straight line in a given direction | B1 |
| 2(b)(i) | distance = speed \times time = 6.0×0.71 = 4.3 m | A1 |
| 2(b)(ii) | $s = ut + \frac{1}{2} at^2$ = $\frac{1}{2} \times 9.81 \times 0.71^2$ | C1 |
| | = 2.5 m | A1 |
| 2(b)(iii) | $\tan \theta = 2.5 / 4.3$ or hypotenuse = $\sqrt{(4.3^2 + 2.5^2)}$ (= 4.97 m) $\cos \theta = 4.3 / 4.97$ or $\sin \theta = 2.5 / 4.97$ | C1 |
| | $\theta = 30^\circ$ | A1 |

FOURTH

| Question | Answer | Marks |
|----------|--|-------|
| 2(b)(iv) | displacement = $\sqrt{4.3^2 + 2.5^2}$ | C1 |
| | = 4.9 m or 5.0 m | A1 |
| | or | |
| | displacement = $2.5 / \sin 30^\circ$ | (C1) |
| | or | |
| 2(b)(v) | displacement = $4.3 / \cos 30^\circ$ | |
| | = 5.0 m | (A1) |
| | KE = $\frac{1}{2}mv^2$ or GPE = mgh | C1 |
| | initial KE + loss in GPE = final KE | C1 |
| | $(\frac{1}{2} \times m \times 6.0^2) + (m \times 9.81 \times 2.5) = (\frac{1}{2} \times m \times v^2)$ | |
| | $v = 9.2 \text{ m s}^{-1}$ | A1 |

Q3 W24 QP 22 Q3

| | | |
|----------|--|----|
| 3(a)(i) | $E = \sigma / \epsilon$ or $E = \text{gradient}$ | C1 |
| | $E = \text{e.g. } 12 \times 10^7 / 0.0050$ | A1 |
| | = $2.4 \times 10^{10} \text{ Pa}$ | |
| 3(a)(ii) | cross drawn at (1.0%, $24 \times 10^7 \text{ Pa}$), labelled Q | B1 |
| 3(b) | resultant force (in any direction) is zero | B1 |
| | resultant moment / torque (about any point) is zero | B1 |
| 3(c)(i) | (moment =) $33 \times 0.65 / 2$ or $1.5 \times (0.65 - 0.12)$ or $T \sin 50^\circ \times (0.65 / 2)$ | C1 |
| | sum of clockwise moments = sum of anticlockwise moments | C1 |
| | $33 \times (0.65 / 2) + 1.5 \times (0.65 - 0.12) = T \sin 50^\circ \times (0.65 / 2)$ | |
| | tension = 46 N | A1 |
| 3(c)(ii) | $\sigma = F / A$ | C1 |
| | $\pi r^2 = 46 / (1.5 \times 10^7)$ | A1 |
| | $r = 9.9 \times 10^{-4} \text{ m}$ | |

| Question | Answer | Marks |
|-----------|--|-------|
| 3(c)(iii) | elastic limit is not reached or (new) stress is less than (stress at) elastic limit or (new) strain is less than (strain at) elastic limit | M1 |
| | (so the wire behaves) elastically | A1 |

Q4. W24 QP22 Q4

| Question | Answer | Marks |
|----------|--|-----------|
| 4(a) | longitudinal waves have oscillations <u>parallel</u> to the (direction of) transfer of energy | B1 |
| | transverse waves have oscillations <u>perpendicular</u> to the (direction of) transfer of energy | B1 |
| 4(b)(i) | A marked at the open end of the pipe | B1 |
| 4(b)(ii) | $f = v / \lambda$ | C1 |
| | $\lambda = 4 \times 4.5 \times 10^{-2}$ | C1 |
| | $f = 340 / (4 \times 4.5 \times 10^{-2})$ $= 1900 \text{ Hz}$ | A1 |

W24 QP23 Q5b

| | | |
|---------|--|-----------|
| 5(b)(i) | $f_o = f_s v / (v - v_s)$ $f_o = (780 \times 320) / (320 - 39)$ | C1 |
| | maximum frequency = 890 Hz | A1 |

Q5. W23QP23 Q5

| Question | Answer | Marks |
|----------|--|-----------|
| 5(a)(i) | cross labelled Y drawn: at any position where wavefronts cross or centrally in a 'diamond' shape formed between any adjacent wavefronts from A and B | B1 |
| | | |
| 5(a)(ii) | cross labelled Z drawn on a wavefront from one source at a point midway between adjacent wavefronts from the other source | B1 |
| 5(b)(i) | $\lambda = ax / D$ | C1 |
| | $a = (2.9 \times 10^{-5} \times 140) / (1.2 \times 10^{-2})$ | C1 |
| | $= 0.34 \text{ m}$ | A1 |
| 5(b)(ii) | infrared | A1 |

Q6.W23 QP23 Q7

| Question | Answer | Marks |
|-----------|---|-----------|
| 7(a) | current (through a conductor is directly) proportional to potential difference (across the conductor) or vice versa | M1 |
| | (provided that) temperature (of conductor remains) constant | A1 |
| 7(b)(i) | $R = \rho L / A$ | C1 |
| | $\rho = (18 \times 7.2 \times 10^{-8}) / 0.94$ $= 1.4 \times 10^{-6} \Omega \text{ m}$ | A1 |
| 7(b)(ii) | voltmeter reading = 3.1 V | A1 |
| 7(b)(iii) | current in the battery: increase | B1 |
| | voltmeter reading: decrease | B1 |
| 7(b)(iv) | cross marked on the resistance wire to right of the arrowhead of S, but not touching the right-hand end of the resistance wire | B1 |
| 7(c)(i) | $I = Anvq$ $q = 0.93 / [(7.2 \times 10^{-8}) \times (9.0 \times 10^{28}) \times (1.3 \times 10^{-3})]$ | C1 |
| | $q = 1.1 \times 10^{-19} \text{ C}$ | A1 |
| 7(c)(ii) | charge / q (value) is below $1.6 \times 10^{-19} \text{ (C)}$ or charge cannot be below $1.6 \times 10^{-19} \text{ (C)}$ or (the charge carriers / q) should have a charge of $1.6 \times 10^{-19} \text{ (C)}$ | B1 |

Q7.M24 QP22 Q8

| Question | Answer | Marks |
|----------|-------------------------------------|-----------|
| 8(a) | lepton(s) | B1 |
| 8(b)(i) | up or top or charm | B1 |
| 8(b)(ii) | meson(s) | B1 |
| 8(c)(i) | B^- (particle) or electron | B1 |