

Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Mark Schemes

Q1.

- (a) place mirror behind ruler ₁✓

for ₁✓ do not insist on contact between mirror and ruler

1

adjust position (of eye / head) until pin hides / lines up with its own reflection / image ₂✓

condone use of (non-hypotenuse) edge of set-square to define horizontal plane ₁✓

adjust position until horizontal edge of set square meets/is touching pin or wtte ₂✓

if no other mark given award ₁₂✓ = 1 max for 'read value at eye level' OR move (clamped) ruler closer to pin

give credit for any relevant annotation to Figure 1 or in additional sketch

1

- (b) valid strategy using apparatus in **Figure 2**:

y (as the dependent variable) measured (or wtte) for different values of one independent variable (only L or m are acceptable) ₁✓

for ₁✓ must refer to variables only using the symbols and/or terms given in (a);

accept 'weight' / mg as independent variable

condone mock table as intent / $y = \text{'extension'}$

1

identifies the correct control variable (besides w and t) ₂✓

for ₂✓ $L = \text{control variable}$ if $m = \text{independent variable}$ OR $m = \text{control variable}$ if $L = \text{independent variable}$;

if L is being varied and $m = 250 \text{ g}$ is stated, this can be taken as $m = \text{control variable}$ and therefore known;

take a similar approach if m is being varied but in this case L must have a **quoted value** that is $\leq 30 \text{ cm}$;

for more than one independent variable, eg variation of both m and L ₁₂
✗✗ but allow ECF for ₄✓ as long as plot is valid, eg y against mL ₃

1

suitable measuring instruments for L OR w OR t ₃ ₃✓

ANY ONE of the following (for more than one response mark as LIST)

for L : use ruler;

for w : use (any type of vernier) callipers; accept micrometer (screw gauge);

for t : use micrometer (screw gauge); accept digital / electronic (vernier) callipers

1

analysis:

suggests valid plot 4 ✓

identifies correctly how E can be found from a valid plot 5 ✓

for 4 ✓ expect y [by itself or combined with another factor] on one axis and their independent variable [by itself or combined with another factor] on the other axis; do not insist on y as ordinate

1

for 5 ✓ E must be the subject; some examples include:

ordinate	abscissa	$E =$
y	m	$\frac{4 \times L^3 \times g}{w \times t^3 \times \text{gradient}}$
mg	y	$\frac{4 \times L^3 \times \text{gradient}}{w \times t^3}$
y	L^3	$\frac{4 \times m \times g}{w \times t^3 \times \text{gradient}}$
y	$\frac{4 \times L^3}{w \times t^3}$	$\frac{m \times g}{\text{gradient}}$
$\log y$	$\log m$	$\frac{4 \times g \times L^3}{w \times t^3 \times 10^{\text{intercept}}}$
$\log y$	$\log L$	$\frac{4 \times m \times g}{w \times t^3 \times 10^{\text{intercept}}}$

1

[7]

Q2.

(a) (Work done = lost KE = $\frac{1}{2} mv^2$ =) 0.019 (J) ✓

1

(b) Use of $W = Fs$ ✓
(F =) 0.66 (N) ✓

Condone POT error in substitution

ECF from (a)

Alternative:

Use of an appropriate suvat equation **and** use of $F = ma$ ✓

($t = 9.8 \times 10^{-6}$ s)

($a = 6.0 \times 10^8$ m s⁻²)

Condone POT error in substitution

No ECF from 3.1 this route ($F =$) 0.66 (N) ✓

2

(c) Use of Volume = Thickness x area of cross-section ✓

Condone POT errors apart from final answer ($V =$) $8 \times 10^{-4} \times 0.03$ Or
($V =$) 2.4×10^{-5}

(Average density =) $\frac{50+5}{2} = 27.5$ ✓

Use of density = $\frac{\text{mass}}{\text{volume}}$ ✓

Condone use of their density and volume

(mass =) 6.6×10^{-4} (kg) ✓ c.a.o

Alternative:

Use of Volume = Thickness x area of cross-section ✓

Condone POT errors apart from final answer

($V =$) $8 \times 10^{-4} \times 0.03$ Or ($V =$) 2.4×10^{-5}

Use of density = $\frac{\text{mass}}{\text{volume}}$ / (mass =) 1.2×10^{-3} or 1.2×10^{-4} ✓

(Average mass =) $\frac{1.2 \times 10^{-3} + 1.2 \times 10^{-4}}{2}$ ✓

= 6.6×10^{-4} (kg) ✓ c.a.o

Condone use of their density and volume ($50 \text{ kg m}^{-3} = 1.2 \times 10^{-3}$)

($5 \text{ kg m}^{-3} = 1.2 \times 10^{-4}$)

Alternative:

Condone POT errors apart from final answer

Attempts to determine the area under the graph:

Formula for area of a rectangle added to the formula for area of a triangle seen /
formula for the area of trapezium seen ✓

$$5 \times 0.03 + \frac{(50-5) \times 0.03}{2} = 0.825 \text{ (kg m}^{-2}\text{)}$$

$$\text{or } \frac{50+5}{2} \times 0.03 = 0.825 \text{ (kg m}^{-2}\text{)} \checkmark$$

Multiplies their area by 8×10^{-4} ✓

Mass = 6.6×10^{-4} (kg) ✓ c.a.o

4

(d) Q has a larger volume (for the same mass and KE) /

Q has a larger surface area (for the same mass and KE) ✓

Q will experience a greater resistive force (at any given speed) / Q will displace
more matter per unit distance ✓

Q will do more work per unit distance / Q will transfer more of its kinetic energy per
unit distance / Q will experience a greater deceleration ✓

Must have Q will travel a shorter distance for all 3 marks.

