Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

(a) attempt to apply principle of moments either about pivot or (LH) end of ruler $_1$✔

mass = 127(.04) (g) $_2$✔

assumption is that ruler is <u>uniform</u> / <u>mass</u> evenly distributed **OR**

<u>weight</u> acts at the centre/mid-point/middle **OR**

<u>centre of mass</u> / gravity is at the centre/mid-point/middle $_3$✔

for $_1$✔ for evidence of moments taken expect clockwise and anticlockwise moment;
for moment about pivot expect to see either 29 or 49; for use of LH end of ruler expect 30 or 50
don't insist on seeing masses in kg, distances in m or the inclusion of 9.81 or g in the working; condone g seen on one side only
rounding to 127 g earns $_1$✔ and $_2$✔

3

(b) <u>force</u> on wire is <u>upwards</u> **OR** ↑ $_1$✔

<u>current</u> is <u>from **P** to **Q**</u> **OR** <u>rightwards</u> **OR** (left) to (the) right **OR** → $_2$✔

states direction of force and direction of current (or $_3$✔ = 0) and makes a suitably justified deduction, eg

using <u>left-hand rule</u> **OR** LH rule

AND

B is <u>into the page</u> **OR** into plane of **Figure 3 OR** ⊗ $_3$✔

for $_1$✔ condone 'motion is upwards'
*for $_2$✔ 'towards Q' **OR** 'positive to negative' are not enough*
*allow logically correct (using LH rule) $_3$✔ for either <u>downwards</u> force with correct current **AND/OR** <u>upwards</u> force with wrong current*
increased flux density below wire is acceptable alternative to LH rule

3

(c) gradient calculated from ΔM divided by ΔI, condone read off errors of ± 1 division; minimum I step ≥ 2.0 A $_1$✔

evidence of g = 9.81 or 9.8 <u>correctly</u> used in working for σ or B $_2$✔

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|*B*| in range 1.76×10^{-2} to 1.87×10^{-2} or 1.8×10^{-2} (T) $_3$✔

for $_1$✔ expect (–)0.28 (g A^{-1}); do not penalise for missing – sign

for $_2$✔ look for σ = their gradient × 9.81 (× 10^{-3} N)

OR $B = \dfrac{\text{their gradient} \times 9.81\left(\times 10^{-3}\right)}{15\left(\times 10^{-2}\right)}$ *; condone POT errors*

for $_3$✔CAO by correct method only; ignore – sign if provided; no limit on maximum sf

3

(d)

	Reduced	No effect	Increased
Force acting on wire		$_1$✔	
Force acting on prism	$_2$✔		
Gradient of graph	$_3$✔		
Vertical intercept	$_4$✔		

$_1$✔ = 1 mark

$_2$✔ = 1 mark

$_3$✔ and $_4$✔= 1 mark

allow any distinguishing mark as long as only one per row

for ✔ and ✗ in same row ignore ✗

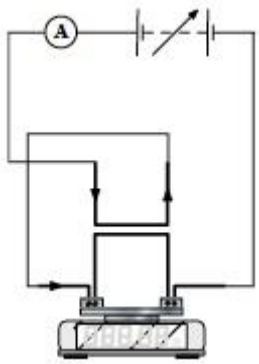
for ✔ and ✔ in same row give no mark

ignore any crossed-out response unless only distinguishing mark on row

3

(e) any complete circuit connecting the power supply in **Figure 6** to **X** and to **Y** that produces currents in **X** and in **Y** that travel left to right $_1$✔

wiring correct so that **X** and **Y** are in series (see below) $_2$✔



allow parallel circuit for $_1$✔ but reject use of additional power supply

*if **X** and/or **Y** is/are short-circuited award no marks;*

for impractical circuits eg voltmeter added in series, award no marks

ignore any current arrows added to diagram

2

(f) strategy:

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states that readings of M (as the dependent variable) will be measured for different values of independent variable, I or d only $_1$✔

clearly identifies the correct control variable, d or I only;

condone $\frac{d}{L}$ = constant if I varied **OR** I^2L OR IL = constant if d varied;

it must be clear how the value of the control variable is known $_2$✔

states that L will be measured or gives value eg L = 5.0 cm $_3$✔

use of g to convert M reading to F; evidence may be found in expression for k $_4$✔

for $_1$✔ condone F identified as the dependent variable or as the balance reading;

reject 'measure change in mass / change in F'

failure to make M or F the dependent variable cannot score $_1$✔ or $_2$✔

for $_2$✔if d is being varied and I = 5.0 A is stated, this can be taken to mean I is the control variable and the value is known

*for $_1$✔ and for $_3$✔ insist that M and L are being <u>read</u> **OR** <u>measured</u> **OR** <u>recorded</u>*

for $_4$✔ 'work out force' is not enough; reject 'acceleration' for g

MAX 3

analysis:

suggests a plot with M or F [by itself or combined with another factor] on the vertical axis and some <u>valid manipulation</u> of their independent variable on the horizontal axis $_5$✔

identifies correctly how k can be found using the gradient of their graph; k must be the subject of the expression given $_6$✔ **OR**

if suggesting a plot with log M or log F on the vertical axis etc identifying correctly how k can be found from the graph intercept $_6$✔

OR

suggesting a plot with M or F on the vertical axis etc and identifying correctly how k is found using the area under the line $_{56}$ ✔ = 1 MAX

the intention to plot M against I^2 is taken to mean that M is the <u>dependent</u> variable and is plotted on the vertical axis

examples: plot M against I^2 will earn $_5$✔

and then $k = \frac{g \times d \times \text{gradient}}{L}$ *will earn $_6$✔*

or plot F against $\frac{1}{d}$ will earn $_5$✔ and then

$k = \frac{\text{gradient}}{I^2 \times L}$ *will earn $_6$✔ (note that when F is the dependent variable g will not appear in the expression for k)*

2

[19]

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