Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) extension of wire Q = 2.7 (mm) ✔

ignore any precision given eg ± 0.1 mm
if > 2 sf condone if this rounds to 2.7

1

(b) mass = 5.8 (kg) ✔

allow ce for incorrect 0.1.1 (only look at 01.1 if answer here is incorrect)
allow ± 0.1 kg

1

(c) 0.51 (mm) ✔

ignore any precision given eg ± 0.005 mm

1

(d) method 1:

use of $E = \frac{\text{(tensile) stress}}{\text{(tensile) strain}}$ 1 ✔

for 1 ✔ expect to see some substitution of numerical data

cross – section area from $\frac{\pi \times d^2}{4}$ 2 ✔

correct use of diameter for 2 ✔; ignore power of ten error; expect CSA = 2.0(4) × 10^{-7}; allow ce from 01.3 (eg for d = 0.37 mm CSA = 1.0(8) × 10^{-7} m^2)

$\text{(tensile) stress} = \frac{mg}{\text{CSA}}$ 3 ✔

penalise use of g = 10 N kg^{-1}

$\text{(tensile) strain} = \frac{\Delta l}{l}$ 4 ✔

value of Δl must correspond to Figure 2 value of m; answers to 01.1 and 01.2 are acceptable
expect l = 1.82 m but condone 182 etc; accept mixed units for l and Δl

MAX 3

method 2:

evidence of $\frac{\Delta l}{\Delta m}$ from Figure 2 to calculate gradient 1 ✔

expect gradient between 0.45 to 0.48 mm kg^{-1}

Downloaded from www.merit-minds.com

$E = \frac{g \times \text{original lenght}}{\text{CSA} \times \text{gradient}}$ $_2$✔ $_3$✔

missing g loses $_3$✔

substitution of l = 1.82 m $_4$✔

condone 182 etc $_4$✔

cross-sectional area from $\frac{\pi \times d^2}{4}$ $_5$✔

correct use of diameter for $_2$✔*; ignore power of ten error; expect CSA = 2.0(4) × 10^{-7}; allow ce from 01.3 (eg for d = 0.37 mm CSA = 1.0(8) × 10^{-7} m^2)*

MAX 3

result in range 1.84 × 10^{11} to 1.91 × 10^{11} $_5$✔

condone 1.9 × 10^{11}

5✔ *mark requires correct working and no power of ten errors: allow ce for error(s) in 01.1, 01.2 and for false/incorrect CSA (eg for d = 0.37 mm allow result in range 3.49 × 10^{11} to 3.63 × 10^{11}, 3.5 × 10^{11} or 3.6 × 10^{11})*

1

(e) (smaller diameter) produces larger extensions $_1$✔
reduces (percentage) uncertainty (in extension and in result for Young Modulus) $_2$✔

(smaller diameter) increases (percentage) uncertainty in diameter **or** cross sectional area is smaller **or** increases (percentage) uncertainty in cross sectional area $_3$✔
increases (percentage) uncertainty (in result for Young Modulus) $_4$✔

(smaller diameter) increases likelihood of wire reaching limit of proportionality or of wire snapping or reduces range of readings $_5$✔
increases (percentage) uncertainty (in result for Young Modulus) $_6$✔

outcome and correct consequence for 2 marks, ie $_1$✔ *followed by* $_2$✔, $_3$✔ *followed by* $_4$✔ *etc*

dna 'error' for 'uncertainty'

no mark for consequence if outcome not sensible, eg 'it gets longer and reduces uncertainty' earns no mark for 'diameter smaller so uncertainty greater' award $_1$✔ *(need to see further mention of uncertainty to earn* $_2$✔*)*

MAX 4

[11]

Q2.

(a) tensile stress is the force exerted per/over <u>cross sectional area</u> ✔

can use equation but must define terms

1

tensile strain is the extension per/over <u>original length</u> ✔

NOT compared to

1

(b) material is brittle ✔

2nd mark dependent on first

1

Downloaded from www.merit-minds.com

shown on graph by little or no of plastic behaviour OR by linear behaviour/straight line to breaking stress ✔
OR
material has high Young modulus OR material is stiff ✔
shown on graph by large gradient/steep line (compared to other materials) ✔

1

(c) area = $\pi \times (1.5 \times 10^{-4})^2/4 = 1.77 \times 10^{-8}$ ✔

1

tensile force = 1.77×10^{-8} ✔

1

= 23 (N) ✔

1

if use diameter as radius −1
if use incorrect formula (d^2 $2\pi r$ etc. −2)
range 22.5 – 24
power of ten error −1
if calculated area incorrectly get following answers
diameter as radius = 92 (2 marks)
d^2 = 7.3 (1 mark)
$2\pi r$ = 610 000 (1 mark)
if use d for area then zero

(d) **The mark scheme gives some guidance as to what statements are expected to be seen in a 1 or 2 mark (L1), 3 or 4 mark (L2) and 5 or 6 mark (L3) answer. Guidance provided in section 3.10 of the 'Mark Scheme Instructions' document should be used to assist marking this question.**

Level 3
Correct materials selected for **each** application (B/C for lift and D for bungee). One reason for choices given for **each** application and explanation why at least one other material would be rejected for **each** application.

6

Correct materials selected for **each** application (B/C for lift and D for bungee). One reason for choices given for **each** application and explanation why at least one other material would be rejected for **one** application.

5

The student presents relevant information coherently, employing structure, style and sp&g to render meaning clear. The text is legible.

Level 2
Correct material selected for **one** application (B/C for lift and D for bungee). **One** reason for choice given for one application and explanation why at least one other material would be rejected for **one** application.

4

Correct material selected for **one** application (B/C for lift and D for bungee). **One** reason for choices given application.
OR
Correct materials selected for **each** application (B/C for lift and D for bungee). One reason for choices given for **each** application

3

The student presents relevant information and in a way which assists the communication of meaning. The text is legible. Sp&g are

Downloaded from www.merit-minds.com

sufficiently accurate not to obscure meaning.

Level 1
No correct material selected but at least **two** properties necessary for an application given.

2

No correct material selected but at least **one** property necessary for an application given.

1

The student presents some relevant information in a simple form. The text is usually legible. Sp&g allow meaning to be derived although errors are sometimes obstructive.

Level 0
No correct material selected and no properties necessary for an application given

The student's presentation, spelling and grammar seriously obstruct understanding.

0

The following statements may be present for cable supporting a lift

material B/C is used for the lift because it has a high breaking stress and a high Young modulus

material A not chosen because lower breaking stress

material A not chosen because fails without warning

material C not chosen because has a lower breaking stress

material D not chosen as larger increase in strain for a given increase in stress

material D not chosen as low breaking stress.

material D a given stress produces a large strain meaning large extension

The following statements may be present for rope or cable used for bungee jump

material D chosen as due large strain for given stress
time taken to come to rest lengthens

material D is chosen because D can store a large amount of energy before failure

not A ,B or C because high Young Modulus so sudden stop resulting in large forces

not A as brittle and therefore limited strain and sudden failure

not C because requires a large strain before plastic behaviour

not C because if behaves plastically will not return to original length

[13]

Downloaded from www.merit-minds.com