Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section A(Practical Skills Set-2)

Name of the Student:____

Max. Marks : 18 Marks **Time : 18 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

$\text{cross-section area from} \frac{\pi \times d^2}{4}$ $_2$✔

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}

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

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) nuclear fallout / testing / weapons / nuclear accidents / Chernobyl / nuclear waste / nuclear medicine / X-rays / specific uses of radioactive sources eg medical tracers CT scan etc. / cosmic rays as a result of air travel ✔
(Any source of radiation that an individual may encounter which would not have existed 100 years ago)

No mark for general answers such as 'medical' or Nuclear Power / nuclear plant.

If a list is given all must be correct but ignore generalisations such as medical or nuclear power.

1

(b) (i) I_{15CCR} = 2050 – 40 = 2010 ✔

Use of inverse square law eg $I_{CCR90} = I_{CCR15}\left(\frac{d_{15}}{d_{90}}\right)^2$ √ = 2010 × (0.15 / 0.90)^2 = 55.8

I_{90CR} = 55.8 + 40

I_{90CR} = 96 counts min^{-1} ✔

regardless of order:

1st mark subtraction of background in original data

2nd mark is for using inverse square function

3rd mark is for the answer

3

(ii) (reduce impact of) random error / decrease the (percentage) uncertainty / improve the statistics (because the percentage error is proportional to the inverse square-root of the count) ✔ (owtte)

The answer must be an uncertainty related statement and not increases reliability / accuracy or increased chance of a reading (although these ideas can accompany a correct answer) Ignore comparisons with the background count.

1

(iii) use (sensible) absorber between source and detector ✔ (sensible absorber means it must have a noticeable effect e.g. 1mm of metal / aluminium sheet / 5mm perspex but do not allow metal foil / paper sheets. Also its effect must not be so great that it reduces the gamma rays noticeably)

(These two marks are independent)
β shown by count rate falling when sheet of aluminium absorber is used ✔ Or (using the existing apparatus)
Compare the results (at various distances) in air with the expected inverse square law ✔
Below the range of beta law does not work but above range it does. ✔

2nd mark no mark given if count rate falls to zero as γ is still present

(magnetic deflection is not common but if seen.

Use of magnetic deflection ✔ correct deflection of beta from the beam ✔)

(If a cloud chamber is suggested. Observe the tracks in a cloud chamber ✔ beta tracks have varying lengths or they are curly / not straight ✔

(The value of the range of beta is not a marking point so accept 15 – 80 cm if a number is given)

2

[7]