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

Mark Schemes

Q1.

(a) Background radiation ✔
Background count = 20 count/minute unit required ✔

Ignore any –ve sign for background count
Must be written to 2 sf

2

(b) Correct line of best fit ✔

The line must be a straight line (as instructed), with approximately an equal number of points on either side of the line.

1

(c) Triangle drawn with smallest side at least 8 cm ✔
(or 8 grid squares)
correct values read from graph ✔
gradient = – 0.00698 (± 0.00030) min^{-1} ✔
must have –ve sign and must be to 2 or 3 sf ✔

Gradient must lie within limits stated. No ecf from incorrectly read values unless it falls within stated limits. No unit penalty.

3

(d) Recognises gradient = (–) λ **or**
Uses gradient for value of λ = 7.0 (± 0.30) × 10^{-3} $minute^{-1}$ ✔
$T_{½}$ = 99 minutes to 2 or 3 sf ✔

For 1st mark accept evidence that value of gradient has been substituted into correct formula for half life. No penalty for missing –ve sign. Allow ect from incorrect gradient value.
Unit penalty if half life has been calculated in different unit (to minutes stated in question)

2

(e) Random ✔

1

(f) (i) Uncertainty = (± √429) = ± 21
No sf penalty ✔

Details of calculation not required. Marks can be awarded for correct numerical answers. Also no penalty for quoting uncertainty or % uncertainty without '±'.

1

(ii) % uncertainty = ± 4.9% ✔
No sf penalty. (Note that % uncertainty in total count is same as % uncertainty in

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corresponding count rate.)

Accept also 4.8% (number achieved keeping all sig figs in calculator)
No penalty for omitting % or '±'.
No sf penalty

1

(iii) % uncertainty for 84 counts is ± 10.9% ✔
Taking data over larger time period / larger total count will have smaller percentage uncertainty. ✔

Accept ±11%
No penalty for omission of ± sign. No sf penalty for estimated % uncertainties.

2

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Q2.

(a) any **two** from

freefall is too quick (any indication of slower motion) **(1)**

(Galileo had) no (accurate) method to **time** freefall (or valid comment regarding timing of freefall or inclined plane) **(1)**

correct reference to **air** resistance or **drag** (not 'wind') **(1)**

max 2

(b) (i) 0.20 × 9.81 = 1.962 (N) **(1)**

(1.962 sin 1.8 =) 0.0616 or 0.062 seen **(1)** (allow 0.061)
(0.0628 for use of g = 10 gets 1 mark)

2

(ii) 0.06(16)/0.20

or use of $a = F/m$ with a clearly identified force but not the weight

or g sinθ = g sin 1.8° **(1)**

0.31 (m s^{-2}) **(1)** (0.308)
accept 0.3 or 0.30 correct answer only for second mark

or ($a = 2s/t^2$)

= 2 × 0.29/1.4^2 **(1)** = 0.31 **(1)** or use of other values from table

2

(c) accelerating **(1)** (accept increasing speed, etc but not increasing acceleration/quicker motion, etc)

greater distance for each additional swing ('per unit time' must be implied) or gradient/ steepness/ slope increasing **(1)** (accept curves upwards)

2

(d) **tangent used:**

tangent drawn at 3.0 m ± 0.3 on graph **(1)**

their time from graph × 1.4 **(1)**

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= 1.28 to 1.44 (m s^{-1}) **(1)**

or suvat used:

use of $v = \frac{2s}{t}$ or $v = (u) + at$ with a from (b) (ii) **(1)**

(t =) 4.4 to 4.5 (s) **(1)**

(speed =) 1.3 to 1.4 (m s^{-1}) **(1)**

3

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