## UNIT 2: FORCES, SPACE and RADIOACTIVITY

 FOUNDATION TIER
## MARK SCHEME

GENERAL INSTRUCTIONS

## Recording of marks

Examiners must mark in red ink.
One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).
Question totals should be written in the box at the end of the question.
Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.
Marking rules
All work should be seen to have been marked.
Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.
Crossed out responses not replaced should be marked.
Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

| cao | $=$ correct answer only |
| :--- | :--- |
| ecf | $=$ error carried forward |

ecf $=$ error carried forward
bod $=$ benefit of doubt

| Question |  |  | Marking details |  | Marks Available |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | A01 | AO2 | AO3 | Total | Maths | Prac |
| 1 | (a) |  |  |  | Statement <br> Atoms of all of these isotopes have the same <br> number of protons in their nuclei. <br> An atom of uranium has 92 neutrons in its <br> nucleus. <br> An atom of californium has the greatest number of <br> protons in its nucleus. <br> An atom of californium has the smallest number <br> of neutrons in its nucleus. <br> Uranium is not a naturally occurring element. <br> An atom of uranium has 92 protons in its nucleus. <br> 1 mark for each correct answer |  |  | 3 |  | 3 |  |  |
|  | (b) |  | $\begin{gathered} 234(1) \\ 90(1) \end{gathered}$ |  |  | 2 |  | 2 |  |  |
|  | (c) |  | $\begin{aligned} & { }_{92}^{232} \mathrm{U}(1) \\ & \text { and }^{235} \mathrm{G} \mathrm{U}(1) \end{aligned}$ |  | 2 |  |  | 2 |  |  |
|  |  |  | Question 1 total |  | 2 | 5 | 0 | 7 | 0 | 0 |



| Question |  |  | Marking details | Marks Available |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | A01 | AO2 | AO3 | Total | Maths | Prac |
| 3 | (a) |  |  | Lead, aluminium, beta, gamma. <br> All four correct - 3 marks <br> 2 or 3 correct - 2 marks <br> 1 correct - 1 mark |  |  | 3 | 3 |  |  |
|  | (b) | (i) | Radioactive decay is a random process. | 1 |  |  | 1 |  |  |
|  |  | (ii) | $\begin{aligned} & \text { Mean }=20(1) \\ & \frac{20}{60}=0.33[\text { counts } / \mathrm{s}](1) \end{aligned}$ |  | 2 |  | 2 | 2 |  |
|  |  | (iii) | Rocks / cosmic / radon / food | 1 |  |  | 1 |  |  |
|  |  |  | Question 3 total | 2 | 2 | 3 | 7 | 2 | 0 |



|  |  |  |  | 0 marks <br> No attempt made or no response worthy of credit. |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Question 4 total | 7 | 2 | 0 | 9 | 3 | 0 |

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| Question |  |  |  | Marking details | Marks Available |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | AO1 | AO2 | AO3 | Total | Maths | Prac |
| 5 | (a) | (i) |  | $W \times 20=5 \times d$ | 1 |  |  | 1 | 1 |  |
|  |  | (ii) |  | All 6 points correctly plotted within $\pm 1 / 2$ small square division (2) 5 points correctly plotted within $\pm 1 / 2$ small square division (1) 1-4 points correctly plotted within $\pm 1 / 2$ small square division (0) Correct straight line of best fit within $\pm 1 / 2$ small square division of all points (1) Don't accept thick, double, whispy lines |  | 3 |  | 3 | 3 | 3 |
|  |  | (iii) |  | 2.5 [N] |  | 1 |  | 1 | 1 | 1 |
|  |  | (iv) |  | 24 [cm] |  | 1 |  | 1 | 1 | 1 |
|  |  | (v) |  | As $d$ increases, $W$ increases (1) in proportion / doubling each time $d$ doubles (or similar)(1) |  | 2 |  | 2 |  | 2 |
|  |  | (vi) |  | Repeat readings would not have been necessary (1) as all of the results are perfectly along a straight line (1) |  |  | 2 | 2 |  | 2 |
|  | (b) |  |  | Anticlockwise moment $=40 \times 7=280[\mathrm{~N} \mathrm{~cm}](1)$ <br> Clockwise moment $=(10 \times 20)+(8 \times 10)=280[\mathrm{~N} \mathrm{~cm}](1)$ <br> Claim is correct because moments are the same (1) |  |  | 3 | 3 | 2 | 3 |
|  |  |  |  | Question 5 total | 1 | 7 | 5 | 13 | 8 | 12 |


| Question |  |  | Marking details | Marks Available |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | A01 | AO2 | AO3 | Total | Maths | Prac |
| 6 | (a) | (i) |  | Slow down the neutrons | 1 |  |  | 1 |  |  |
|  |  | (ii) | Absorb neutrons | 1 |  |  | 1 |  |  |
|  |  | (iii) | Absorb radiation | 1 |  |  | 1 |  |  |
|  | (b) | (i) | [Nuclear] fission | 1 |  |  | 1 |  |  |
|  |  | (ii) | Barium OR krypton | 1 |  |  | 1 |  |  |
|  | (c) |  | 1. The waste is very radioactive (1) <br> 2. The waste has a long half-life (1) | 2 |  |  | 2 |  |  |
|  |  |  | Question 6 total | 7 | 0 | 0 | 7 | 0 | 0 |




| Question |  |  | Marking details | Marks Available |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | A01 | AO2 | AO3 | Total | Maths | Prac |
| 9 | (a) |  |  | The ball decelerates as it rises until it comes to a stop vertically (1) <br> then it accelerates as it falls (1) <br> because gravity pulls down on it (1) |  | 3 |  | 3 |  |  |
|  | (b) | (i) | $\begin{aligned} \text { Change in momentum } & =0.16 \times(0-40)(1) \\ & =[-] 6.4[\mathrm{~kg} \mathrm{~m} / \mathrm{s}](1) \end{aligned}$ | 1 | 1 |  | 2 | 2 |  |
|  |  | (ii) | Selection and substitution: <br> $\frac{6.4}{0.4}(1)$ ecf <br> $=16[\mathrm{~N}](1)$ <br> $32(\mathrm{~N}$ | 1 | 1 |  | 2 | 2 |  |
|  |  | (iii) | 32 [ N ] ecf |  | 1 |  | 1 | 1 |  |
|  | (c) |  | Bend knees on landing (1) Increases time to stop (1) which decreases the force on legs (1) |  |  | 3 | 3 |  |  |
|  |  |  | Question 9 total | 2 | 6 | 3 | 11 | 5 | 0 |

## FOUNDATION TIER

## SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

| Question | AO1 | AO2 | AO3 | TOTAL <br> MARK | MATHS | PRAC |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 2 | 5 | 0 | 7 | 0 | 0 |
| 2 | 7 | 2 | 0 | 9 | 4 | 0 |
| 3 | 2 | 2 | 3 | 7 | 2 | 0 |
| 4 | 7 | 2 | 0 | 9 | 3 | 0 |
| 5 | 1 | 7 | 5 | 13 | 8 | 12 |
| 6 | 7 | 0 | 0 | 7 | 0 | 0 |
| 7 | 2 | 4 | 2 | 8 | 6 | 0 |
| 8 | 2 | 4 | 3 | 9 | 6 | 0 |
| 9 | 2 | 6 | 3 | 11 | 5 | 0 |
| TOTAL | 32 | 32 | 16 | 80 | 34 | 12 |

