

| Question number | Answer | Notes | Marks |
|-----------------|--|---|------------|
| 3 (a) | 16.5 \pm 0.2; cm; | ACCEPT: 2 nd dp if in this range ACCEPT: centimetres / cms ACCEPT: 165 mm \pm 2 for 2 marks ACCEPT: 0.165 m \pm 0.002 for 2 marks | 1 1 |
| (b) | Any two of: line up (end of) pencil with zero / any other scale mark ; avoid parallax / look straight down / take reading at right angles OWTTE ; use 0.5 cm scale / other side of ruler ; | REJECT: line up with end of ruler IGNORE: put pencil on top of ruler REJECT: use mm scale IGNORE: repeat readings / average | 2 |

Total 4 Marks

| Question number | Answer | Accept | Reject | Marks |
|-----------------|---|---|-----------------------------------|-------|
| 5 (a) (i) | moment = force x distance | Correct equivalent e.g. moment = $F \times d$ If (i) is blank, but correct equation written in (ii), then credit. | m for moment equation "triangles" | 1 |
| (ii) | Substitution 4.2×0.25 ; Calculation 1.05 (N m) ; | Correct answer gets both marks ACCEPT: 1.1 (N m) | | 2 |
| (b) | (Moment of) weight of lid; Acts in same direction as closing force / anticlockwise; | Pull / force of gravity Acts downwards Reverse argument related to opening lid IGNORE: any reference to energy | Bald "gravity" for weight | 2 |

Total 5 Marks

| Question number | Answer | Notes | Marks |
|-----------------|---|---|-------|
| 11 (a) | Mass of cylinder + unit = 325 ; Mass of cylinder = 106 ; Mass of liquid in cylinder = 219 ; Volume of liquid = 176 ; Mass unit: g ; Volume unit: cm^3 / ml ; | ACCEPT: ecf on M1 and M2 ACCEPT: either unit used appropriately at least once | 6 |
| (b) | Any two from: equation; correct substitution made or correct mass indicated; density = between 1.24 and 1.25; density unit (g/cm^3 OR g/ml); | ecf from 11(a) Correct and consistent alternative e.g. 1240 kg/m^3 1.24 kg/dm^3 | 2 |
| (c) | Any two from: more sensitive equipment ; check balance zero ; calibrate any equipment ; avoid parallax when reading measuring cylinder / bottom of meniscus ; use larger volume of liquid ; | ACCEPT: measure to more dp / use burette IGNORE: repeat experiment IGNORE: refs to "use more accurate..." | 2 |

Total 10 marks

| Question number | Answer | Notes | Marks |
|-----------------|--|--|-------|
| 13 (a) (i) | 77 | | 1 |
| (ii) | 115 | | 1 |
| (b) | (nuclei with) same number of protons / same atomic number / same element ; different numbers of {neutrons / nucleons} / different mass number; | ACCEPT: atoms / elements for nuclei REJECT: molecules / substances for nuclei IGNORE: electrons | 2 |
| (c) | 192; 78; | | 2 |
| (d) | alpha not penetrating enough (of the tumour) / ionises before reaching whole tumour ; gamma too penetrating / travels straight through / too weakly ionising / OWTTE ; beta will penetrate the tumour but no further / stays in tumour and doesn't affect horse / ionises within tumour (but no further) / OWTTE ; | IGNORE: doesn't penetrate skin IGNORE: bald 'weak' or 'strong' IGNORE: general properties of alpha, beta and gamma | 3 |
| (e) (i) | C | | 1 |
| (ii) | activity decreases over time ; relate activity to situation e.g. C remains sufficiently active (over the treatment) / A and B not effective over period of treatment / A and B would need source to be replaced / D continues to be radioactive / cause damage (after treatment) ; | ACCEPT: calculation of period of activity IGNORE: bald 'weak' or 'strong' | 2 |

Total 12 marks