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

**Total 4 Marks**

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 12 | | | 4 |
| M1 | pressure greater in the full cup / less in the half-full cup ; | | |
| M2 | reference to equation / p = W ÷ A / p = h x ρ x g ; | ACCEPT: F in place of W | |
| M3 | {depth / mass / weight} of liquid / force different in each cup ; | IGNORE: amount of coffee different | |
| M4 | density / g / area the same for each cup ; | | |

**Total 4 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 ;<br>different numbers of {neutrons / nucleons} / different mass number; | ACCEPT: atoms / elements for nuclei<br>REJECT: molecules / substances for nuclei<br>IGNORE: electrons | 2 |
| (c) | 192;<br>78; | | 2 |
| (d) | alpha not penetrating enough (of the tumour) / ionises before reaching whole tumour ;<br><br>gamma too penetrating / travels straight through /too weakly ionising / OWTTE ;<br><br>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<br><br>IGNORE: bald 'weak' or 'strong'<br><br>IGNORE: general properties of alpha, beta and gamma | 3 |
| (e) (i) | C | | 1 |
| (ii) | activity decreases over time ;<br>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<br>IGNORE: bald 'weak' or 'strong' | 2 |

**Total 12 marks**