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|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7(a)      | <ul style="list-style-type: none"> <li>force per unit length</li> <li>force per unit current</li> <li>length / current perpendicular to field</li> </ul> <p>1 mark for any two points, 2 marks for all three points.</p> |
| 7(b)(i)   | $F = BQv$                                                                                                                                                                                                                |
| 7(b)(ii)  | arrow at Y pointing vertically upwards                                                                                                                                                                                   |
| 7(b)(iii) | upwards deflection showing circular path                                                                                                                                                                                 |
| 7(c)(i)   | electric field applied vertically downwards (may be shown on a labelled diagram)                                                                                                                                         |
|           | electric force on particle in opposite direction to magnetic force (may be shown on a labelled diagram)                                                                                                                  |
|           | particle undeflected when magnitudes of electric and magnetic forces are equal                                                                                                                                           |
| 7(c)(ii)  | $EQ = BQv$                                                                                                                                                                                                               |
|           | $v = E / B$                                                                                                                                                                                                              |

|      |                                                                                                                                                                            |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6(a) | $F_B = F_E$                                                                                                                                                                |
|      | <p>either: <math>Bqu = qE</math> and <math>E = V / d</math> leading to <math>u = V / Bd</math></p> <p>or: <math>Bqu = qV / d</math> leading to <math>u = V / Bd</math></p> |
| 6(b) | $E_k = \frac{1}{2}mu^2$                                                                                                                                                    |
|      | $u = \sqrt{[(2 \times 4.1 \times 10^{-17}) / (3.2 \times 10^{-27})]}$<br>$= 1.6 \times 10^5 \text{ms}^{-1}$                                                                |
|      | $B = 980 / (3.6 \times 10^{-2} \times 1.6 \times 10^5)$<br>$= 0.17 \text{ T}$                                                                                              |
| 6(c) | expression is independent of mass and charge                                                                                                                               |
| 6(d) | <p>either: electric force is downwards so magnetic force is upwards</p> <p>or: no resultant force so magnetic force is upwards</p>                                         |
|      | (positive ions so) current is from left to right                                                                                                                           |
|      | from (Fleming's) left-hand rule, magnetic field is into the page                                                                                                           |
| 6(e) | curved path inside plates with consistent direction of curvature and with no discontinuity at entry or in curvature                                                        |
|      | direction of deflection is upwards                                                                                                                                         |