Temporary Answers for the Tutorial

## Forces on Charged Particle Tutorial Answers

### Tutorial 1 – Motion in Fields

**1**

1. (i) The electron will curve out of the page. (ii) The electron will curve to its right. (to the left as we look at it) (iii) There will be no change in the direction of the particle as the neutron has no charge.
2. (i) The alpha particle will curve into the page (ii) The alpha particle will curve to its left (to the right as we look at it). (iii) the alpha particle will move upwards

2.

(a) This obey’s the Right hand motor rule or the left hand slap rule

(b) In figure 2 the force should be drawn acting vertically downwards, in figure 3 the force should be drawn acting vertically upwards.

(c) 1 The electron current should be shown in the directions of WXYZ round the coil.

2 The force on WX is drawn acting vertically upwards. The force on YZ is drawn acting vertically downwards.

3. When viewed along the direction PQ the coil rotates in a clockwise direction.

(d,ii) More coils allows for smoother rotation, (ii) Allows for the motor to work on a.c.

3 (a)

(b)

**B**

**e-**

The force is directed into the page**.**

4. Out of the page

5. into the page

6.

**B**

**e-**

* + - * 2. Into the page



**B**

**p+**

There will be no force on the alpha particle as it is travelling parallel to the magnetic field.

### Tutorial Answers

**Electric fields**

3. 1·6  10 J

4*.* 8·0  10 J

5. (a) 8·0  10 J , (b) 8·0 10 J, (c) 1·3  10 m s −1 ¶

6. 2·65  10 m s −1

7*.* 2·76  10 m s −1

8. (a) (i) 4·0  10 J , (ii) 9·4  10 m s−1 , (iii) 1·9  10

**Charged particles in a magnetic field**

1. Magnetic field is in the same plane and in the same or opposite direction to the velocity of the electron.

2. C: be deflected upwards

3. (a) no change in direction, (b) out of the paper , (c) into the paper

(d) no change in direction (e) up, (f) left

(g) left , (h) down

**Particle accelerators**

1. (a) 8 × 10−17 J , (b) 8 × 10−17 J , (c) 1·33 × 107 m s −1

2. (a) 4 × 10−17 J , (b) 9·37 × 106 m s −1

3. 2·65 × 107 m s −1

4. 1·38 × 106 m s −1

5. (a) 4 × 10−16 J , (b) 2·96 × 107 m s −1 , (c) 1·88 × 1016

6. (a) 1·25 × 1016 , (b) 7·26 × 107 m s −1

7. (a) (i) 1·6 × 10−16 J

(iii) 3·51 × 1015 m s −2

(iv) 5·34 × 10−9 s

(v) 6·42 × 10−9 s

(b) (i) Same since *Q* and *V* same

(ii) Longer since acceleration is smaller

8. (a) 4·0 × 10−15 J , (b) 9·37 × 107 m s −1, (c) 3·12 × 1016

(d) Heat and X-rays are produced

9. (a) Electron accelerated towards positive plate

(b) Proton accelerated towards negative plate but less curved than that of electron

(c) Neutron straight through.

10. (a) Negative , (b) Positive , (c) Positive, (d) Negative

11. A = alternating electric fields; B = fixed-target; C = alternating electric fields; D = spiral of increasing radius; E = constant magnetic field; F = perpendicular; G = increases; H = physical size; I = relativistic effects; J = fixed-target; K = circular path of fixed radius; L = can be varied; M = alternating magnetic fields; N = increased; O = relativistic effects; P = the same; Q = opposite; R = colliding beam.