

Advanced Higher Physics

Quanta

Problems:

Solutions

# TUTORIAL 1.0

**Quantum Theory**

Numerical answers

1. ±1.1 × 10–23 kg m s–1

2. ±5.65 × 10–9 m

3. ±5.3 × 10–25 J

4. ±1.3 × 10–26 kg m s–1

5. (a) 1.8 × 10–10 m

1. 6.1 × 10–14 m
2. 2.0 × 10–38 m

6. The electron has the larger de Broglie wavelength by 1800 times.

1. (a) 4.7 × 10–13 m
2. 1.4 × 10–21 kg m s–1
3. (a) 8.4 × 106 m s–1
4. 8.7 × 10–11 m
5. Particle behaviour

9. 2.5 × 10–11 m (2.46 × 10–11 m)

10. 940 V

11. 2.4 × 10–11 m (24 pm)

12. (a) (i) 1.06 × 10–34 kg m2 s–1 (1.056 × 10–34 kg m2 s–1)

(ii) 3.2 × 10–34 kg m2 s–1

(b) Show 2πr = nλ

(c) (i) 6.6 × 10–10 m

(ii) 1.3 × 10–9 m

# TUTORIAL 2.0

**Particles from space**

Numerical answers

1. 5.0 × 10–13 N

2. 3.8 × 10–15 N

3. A neutron has zero charge: *q* = 0

4. (a) 6.1 × 10–16 N out from page

(b) Zero force, as velocity is parallel to magnetic field.

5. 4.5 × 106 m s–1

6. 1.6 × 10–19 C

7. 9.1 T

8. (a) 2.1 × 10–13 N

(b) This force is a central force at right angles to the direction of motion.

(c) 2.9 × 10–4 m

9. 0.54 m

10. (a) 45 mm

(b) 2.9 × 10–16 N

11. (a)2.6 × 107 m s–1

(b) 1.1 × 10–7 s

(c) 2.2 × 10–12 J

12. 1.9 × 106 m s–1

13. 0.61 T

14. 9.56 × 107 C kg–1; proton, *q*/*m* for proton = 9.56 × 107 C kg–1

15. (a) *v* cosθ

1. *v* sinθ
2. *v* cosθ stays unchanged ,as it is parallel to the magnetic field

16. (a) 2.3 × 106 m s–1

1. 6.4 × 106 m s–1
2. 2.36 × 10–13 N
3. 1.6 × 10–4 m
4. 1.6 × 10–10 s
5. 3.7 × 10–4 m

17. (a) 4.4 × 105 m s–1

1. 3.7 × 105 m s–1
2. 2.8 × 10–14 N
3. 8.2 × 10–3 m
4. 1.4 × 10–7 s
5. 6.2 × 10–2 m

18. (a) 1.2 × 10–4 m

(b) 5.4 × 10–4 m