Chapter 4 Fission and fusion

Chapter Test Answers Total marks 45

Question 1

a. i 95 ii 146 iii 241 3

b. i 38 ii 52 iii 90 3

Question 2

a.  2

b. The combined mass of the products is less than the mass of the uranium-238. 1

Question 3

**B** The electrostatic repulsive force must be overcome in order for the particles to get close enough to fuse. 1

Question 4

**A** The strong nuclear force overcomes the repulsive electrostatic force inside the nucleus. 1

Question 5

a. There are 3 neutrons, . 1



The nucleon number (initially 236) is down by 3, but the proton number is  
unchanged at 92, so the right-hand side requires 3 neutrons. 1

b. E = (170 × 106) × (1.6 × 10–19) = 2.72 × 10–11 J 1

c. E = mc2 (consequential answer)

⇒ m = = 3.02 × 10–28 kg 2



**d.** E = (170 × 106) × (1.6 × 10–19) × (2.5 × 1024) 1

= 6.8 × 1013 J 1

Question 6

a. i control rod 1  
 ii moderator or fuel rod 1  
 iii fuel rod or moderator 1  
 iv turbine. 1

b. A: Reactor core, where fission occurs. 2

B: Heat exchanger, where coolant from reactor cools by giving its heat to normal water, turning the water into steam. 2

C: Generator, where steam turns turbine and generates electricity. 2

Question 7

In any sample of uranium ore the concentration of the 1  
fissile isotope of uranium, uranium-235, is far too low. 1

Question 8

Coal-fired power stations produce carbon dioxide, a greenhouse gas. 1  
Nuclear power stations have radioactive waste products with long half-lives and/or bring  
the risk of an accident that may release radioactive material into the environment. 1

Question 9

a. 1200 MW = 1200 × 106 W

E = Pt = 1200 × 106 × (24 × 60 × 60) = 1.04 × 1014 J 2

b. Since E = mc2

m = = = 1.16 × 10-17 kg3 = 1.6 g 2



c. 25% of 1.04 × 1014 J = 2.6 × 1013 J 1

Question 10

a. Balancing the mass numbers, one neutron has been released. 1

b. The combined mass of the products is slightly less than that of the reactants. 2

c. 15 MeV = 15 × 106 × 1.6 × 10-19 = 2.4 × 10-12 J. 2

Question 11

**a.** The missing nuclide has an atomic number of 2 and mass number of 4, so is 2



**b.** Energy = 4.0 × 10-12 / 1.6 × 10-19 = 2.5× 107 eV 1