

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Mark Schemes

Q1.

- (a) (i) mass and energy have equivalent values

B1

$E = mc^2$ mentioned

B1

MeV is energy unit (and kg that of mass)

B1

max2

- (ii) clear attempt to substitute amu values into equation

C1

5.135×10^{-3} (u) or 4.78 (MeV) seen

C1

mass of 1 lithium nucleus = 9.98×10^{-27} (kg)

C1

total number of nuclei in 1 kg = 1.00×10^{26}

C1

total energy given out = 4.78×10^{26} MeV

A1

5

- (iii) neutrons needed (for the lithium reaction) can come from the other (deuterium-tritium) reaction

B1

1

- (b) (i) potential energy equation ($E = \frac{Qq}{4\pi\epsilon_0 r}$) quoted or used

| | | | |
|-------|---|----|------|
| | | C1 | |
| | correct substitutions | | |
| | | C1 | |
| | $1.5(3) \times 10^{-13}$ (J) | | |
| | | A1 | 3 |
| (ii) | $k_e = 3/2 kT$ | | |
| | | C1 | |
| | $0.75/0.765 \times 10^{-13}$ (J) or half of (b) (i) or 4×10^9 (K) used | | |
| | | C1 | |
| | 3.7×10^9 (K) or total energy 1.6×10^{-13} (J) | | |
| | | A1 | 3 |
| (iii) | each nucleus carries a positive charge | | |
| | | B1 | |
| | (electrostatically) repel each other | | |
| | | B1 | |
| | strong nuclear force | | |
| | | B1 | |
| | this has a range of nucleus diameters | | |
| | | B1 | |
| | high temperature needed for high kinetic energy | | |
| | | B1 | |
| | | | max4 |

[18]