Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

(a) (i) (use of $P = VI$ gives) P (= 2.4 × 20) = 48 W **(1)**

(ii) incident (solar) power (= 1.4 × 2.5) = 3.5 (kW) **(1)**

efficiency = $\frac{48}{3500}$ **(1)**

= 0.014 **(1)** (or 1.4%)

[or efficiency = $\frac{48}{2.5} / 1400$]

(allow C.E. for incorrect values of input and output power)

4

(b) (i) in 1 s source emits 1.1×10^{14} particles **(1)**
energy emitted in 1 s = $1.1 \times 10^{14} \times 5.1 \times 1.6 \times 10^{-13}$ (J) **(1)** (= 90 J)

(ii) $T_{1/2} = \frac{\ln 2}{\lambda}$ + correct use or $\lambda = \frac{\ln 2}{90 \times 365 \times 24 \times 3600}$ **(1)**

= 2.44×10^{-10} s^{-1} **(1)**

[or $\lambda = \frac{\ln 2}{90}$ = 7.7×10^{-3} yr^{-1}]

(iii) no. of nuclei $\left(= \frac{\text{activity}}{\text{decay constant}} = \frac{11 \times 10^{14}}{2.44 \times 10^{-10}} \right) = 4.5(1) \times 10^{23}$ **(1)**

(allow C.E. for incorrect value of λ in (ii))

mass of isotope = $\frac{4.51 \times 10^{23} \times 0.239}{6.02 \times 10^{23}}$ **(1)**

= 0.18 kg **(1)**

(allow C.E. for incorrect no. of nuclei)

7

[11]

Q2.

(a) (i) straight on or deflection of zero degrees **(1)**

(ii) the atom consists mainly of open space
[or volume of nucleus is (very much) smaller than volume of the atom] **(1)**

2

(b) most of the mass of an atom is contained in its nucleus
[or the mass of the nucleus is greater than the mass of the α particle] **(1)**
the nucleus contains a positive charge **(1)**
the charge is concentrated at the nucleus **(1)**

max 2

(c) (i) electrostatic (force)
[or electromagnetic or coulomb] **(1)**

(ii) arrow pointing away from the nucleus
at the closest distance to the nucleus **(1)**

(iii) path showing less deflection at all times

4

[8]