Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Fields And Their Consequences(Nuclear Physics)

Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

(a) (i) Attempt to use KE = 3/2 kT expect $0.75 = 3/2 \times 1.38 \times 10^{-23} T$

C1

Or correct conversion to J $0.75 \times 1.6 \times 10^{-19}$

Correct equations $0.75 \times 1.6 \times 10^{-19} = 3/2\ 1.38 \times 10^{-23} T$

C1

5800 K

A1

3

(ii) Attempt to use energy = $qQ/4\pi\varepsilon_{or}$

C1

arrives at $1.9(2) \times 10^{-9}$ or uses (2×0.75) or twice candidate's energy from (i)

C1

9.6×10^{-10} m

A1

3

(iii) For fusion nuclei have to touch or separation has to be nuclear diameter

energy has to be sufficient to overcome the nuclear repulsion (between protons)

B1

Close enough for nuclear strong force to act

B1

answer to 4 a (ii) is much greater that 10^{-15} m

B1

or is greater that atomic radius

or is greater than the range of the strong force

3

(b) (i) Use of $pV=NkT$

C1

(Allow incorrect powers of 10 or rearrangement to make N subject)

$1\times10^{16}\times1=N\times1.38\times10^{-23}\times1.5\times10^{6}$

C1

$4.8\ (3)\times10^{32}$

A1

3

(ii) 1.67×10^{-27} or 1.7×10^{-27} used

C1

$8.0 – 8.2\times10^{5}$ (kg m^{-3}) Allow ecf for N from (b)(i)

A1

2

(c) (i) Number of protons = moles of proton/mass of protons / Mass per second × Avogadro constant used

B1

Or

No of protons = mass per second/proton mass

(allow if numerical equation seen with a subject)

4.18 or 4.19 or 4.21×10^{38} correct to at least 2 sf from correct working

B1

2

(ii) Attempt to use $E = mc^2$ with any mass and substitution for c

C1

Energy radiated = $5\times10^{9}\times c^{2}$ energy radiated 4.5×10^{26} J

A1

Number of helium nuclei formed = 1.05×10^{38} (allow 1×10^{39})

B1

Approximate BE per nucleon from article = $4.28(4.5)\times10^{-12}$ J

(Which is consistent)

4

[20]