Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

(a) (i) neutron

B1 **1**

(ii) p = 36

B1

n = 144

B1 **2**

(b) (i) total energy produced = $\frac{500 \times 100}{40}$ MJ each second

C1

number of reaction = 4.2×10^{19} per second

A1 **2**

(ii) 1 kg contains $(1000/235) \times 6.02 \times 10^{23}$ atoms of uranium

C1

total number of fissions = $(1000/235) \times 6.02 \times 10^{23} \times 2 \times 10^{4}$
(5.1×10^{28})

C1

time = total fissions available/number per second or 1.2×10^{9}s

C1

38.7(39) years

A1 **4**

(iii) too few neutrons produced to maintain the chain reaction

B1

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probability of a neutron colliding with a uranium nucleus too low

B1

more absorption of neutrons in non–fission capture

B1

2

(c) pressure = 150×10^5 (Pa) or $F = PA$

C1

force on 1 cm^2 = 1500N

A1

2

(d) energy removed each second

$E = \frac{500 \times 100}{40}$ MJ = 1.25 × 109 J or $E = mc\Delta\theta$

C1

$1.25 \times 10^9 = m\ 5000 \times 40$

C1

mass per second = 6250 kg

C1

volume per second = 8.6(8.56) m^3

A1

4

(e) **control rods**

neutrons are absorbed

B1

by the nucleus of the boron/atoms

B1

moderator

neutrons are slowed down

B1

when colliding with the protons/hydrogen nucleus

B1

4

[21]

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