Ques Which reaction ~~causes~~ produces light energy from the Sun

a) Fusion b) Fission c) Nuclear d) Emission

Ques The operation of a nuclear reactor is said to be critical if the multiplication factor (K) has the value

a) 1 b) 0 c) 0.5 d) 2.1

Ques Which component of the nuclear reactor functions to reduce the energy of fast neutrons to thermal neutrons in a nuclear power plant?

a) Moderator b) Coolant Circulator c) Control Rods d) Shielding

Ques What type of rays are stopped by shielding material used in the reactor?

a) Gamma Rays b) Beta Rays c) X-rays d) IR Rays

Ques Which of the following reactors does not need a moderator?

a) Thermal Rx b) Fast Reactor c) Intermediate Rx d) Power Rx

Ques Which of the following is not used as nuclear fuel cladding material?

a) Cd b) Zr c) Ceramics d) SS

Ques If 8 gm a radioistope has a half life period of 20 days, the half life of 4 gm of the same isotope will be

a) 10 b) 20 c) 40 d) 5

Ques In a radio-active decay which of the following state is changed

a) Physical b) Chemical c) Nuclear d) Nuclear + Chemical

Ques The function of reflector in a nuclear power plant is to

a) decrease the leakage of neutrons
b) control the production of neutrons
c) decrease the speed of neutrons d) increase production of neutrons

Ques The conversion ratio of breeder reactor is

a) zero b) 1 c) more than 1 d) less than 1

Q5) Properties of Gamma Rays →

a) emitted from nucleus of radio active atoms - spontaneous emission
b) emitted with KE related to radio active source
c) highly penetrating - extensive shielding required
d) serious external radiation hazard

Q6) Liquid Drop Model →

a) Each constituent particles interact equally with neighbors (and hence BE α A)
b) Incompressible and homogenous
c) Force between particles are same and short range
d) Surface tension force
e) De-excitation of the drop or CN by cooling, evaporation etc. whereas it is by emission of radiations, emission of one or more particles, fissions etc in a nucleus.

Q7) Properties of Neutrons →

a) Neutrons are neutral, high penetration power
b) They have magnetic moment
c) Neutrons have spin
d) Neutrons have energies
e) Thermal neutrons have λ close to inter atomic spacing
f) Neutrons see nuclei

Q1) Four Statements are given below →

1) The Strong nuclear force binds protons and neutrons in a nucleus
2) Strong nuclear force is the strongest force in nature
3) Short range force
4) Strong nuclear force is responsible for the stability of the nuclei
5) Nuclear free is charge independent

Q2) By integrating which of the following variables in neutron transport equation, one obtains the diffusion equation

a) Angular Ω b) Energy E c) time t d) Space r

Q3) Properties of α particle

a) Most have energies between 4-8 Mev
b) Shielded by paper or layer of skin
c) Primary hazard from internal exposure
d) α emitters can accumulate in tissue (bone, kidney, liver, lung, spleen) causing local damage

Q4) Properties of Beta particle

a) Charge of -1
b) Ejected from nuclei of radioactive atoms
c) Cause skin burns or be an internal
d) Shielded by wood, body penetration 0.2 to 1.3 cm depending on energy

4) The capture X-sec of Al, Zr and Boron, Fe are 0.21, 0.4 and 0.25 barns respectively. Ideal among them for control material in Rx is
a) Zr b) Fe c) Boron d) Al

5) The slowing down power of H_2O, D_2O, Boron and graphite are respectively 1.53, 0.170, 0.091 and 0.064. Which among them is a best moderator?
a) H_2O b) D_2O c) Boon d) Graphite

6) The Q value of fission Rx is of the order
a) 5 MeV b) 20 MeV c) 200 MeV d) 500 MeV.

7) The ~~function~~ safety ~~shut~~ rods to shut down the Reactor are made up of
a) Cu b) Ca c) C d) Cd

8) Select the incorrect statement which support PHWR
a) light Water is used as moderator
b) Uses Nat Uranium.
c) has +ve void Coefficient.
d) has best thermal utilisation.

Ques 1. A Nuclear Reactor producing 1000 MWe by fission of U-235 atoms, with an average load factor of ~~70~~ 80% and with an efficiency of heat into electricity equal 33%. Using mass energy relation, ~~calculate the mass of matter converted into energy in one year~~ mass of U-235 that is fissioned converted into energy during one year. (One fission yields 200 Mev and 1ev equals 1.602×10^{-19} J)

Soln → During one year reactor produces,

$$1000 \times 10^6 \times 0.8 \times \cancel{0.3} \times 3 \times 365 \times 86400 = \cancel{6.162} 7.56 \times 10^{16} \text{ J}$$

Dividing by $c^2 = (3 \times 10^8 \text{ m/sec})^2$, we get mass converted into energy equal to 0.841 kg.

~~One fission yields $200 \times 10^6 \times 1.602 \times 10^{-19} = 3.20 \times 10^{-11}$ J. In this reactor, 2.07×10^{22} fissions occur each year.~~

a) 1 kg b) 0.841 kg c) 0.950 kg d) 0.736 kg.

Ques 2. Consider the fusion Rx

$$^2_1H + {}^3_1H \Rightarrow {}^4_2He + {}^1_0n$$

The amount of energy yielded by this Rx,

a) 200 Mev b) 17.6 Mev c) 20 Mev d) 10 Mev

Deuti = 2.014102 amu
^3_1H = 3.016049 amu
^2_1H = 4.002603 amu
^1_0n = 1.008665 amu.

Ques 3 The Activity in curies of 1 gm of Ra-226 ($t_{1/2}$ = 1599 ys) is

One gm of Ra-226 ⇒ 3.7×10^{10} Bq = 1 Ci

a) 1 Ci b) 10 Ci c) 100 Ci d) 1000 Ci