

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 radioisotope 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 \rightarrow

- 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 \rightarrow

- a) Each constituent particles interact equally with neighbors (and hence $BE \propto A$)
- 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 \rightarrow

- 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 interatomic spacing.
- f) Neutrons see nuclei

Q1) Four statements are given below \rightarrow

- 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 force 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} ~~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) Boron 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 ~~stab~~ 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 PWR

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~~ ^{$U-235$ matter converted into energy as} mass of $U-235$ that is fissioned during one year. (One fission yields 200 Mev and 1ev equals $1.602 \times 10^{-19} \text{J}$)

Solⁿ → During one year reactor produces,

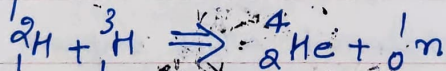
$$1000 \times 10^6 \times 0.8 \times 24 \times 365 \times 86400 = 6.62 \times 10^{16} \text{ J}$$

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 $200 \times 10^6 \times 1.602 \times 10^{-19} = 3.20 \times 10^{-11} \text{ J}$. 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



The amount of energy yielded by this Rx,

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

$$\text{Deut} = 2.014102 \text{ amu}$$

$${}^3_1\text{H} = 3.016049 \text{ amu}$$

$${}^4_2\text{He} = 4.002603 \text{ amu}$$

$${}^1_0\text{n} = 1.008665 \text{ amu}$$

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

$$\text{One gm of Ra-226} \Rightarrow 3.7 \times 10^{10} \text{ Bq} = 1 \text{ Ci}$$

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