Nuclear Power Plant Chemistry Questions with Solutions

Q1. Where is Kakrapar's atomic power station located?
(a) Andhra Pradesh
(b) Gujarat
(c) Madhya Pradesh
(d) None of the above
Answer: (b) Kakrapar's atomic power station is located in Gujarat.

Q2. Where was the first nuclear power plant platnted?
(a) Bombay
(b) Andhra Pradesh
(c) Madhya Pradesh
(d) None of the above
Answer: (a) The first nuclear power plant was planted in Bombay.

Q3. What is the role of the moderator in the nuclear power station?
(a) Absorb the neutrons
(b) Accelerate the speed of neutrons
(c) Reduce the speed of neutrons
(d) None of the above
Answer: (c) The role of the moderator in the nuclear power station is to reduce the speed of neutrons.

Q4. Which of the following material is used to construct the control rod in the nuclear reactor?
(a) Cadmium
(b) Copper
(c) Graphite
(d) None of the above
Answer: (a) Cadmium is used to construct the control rod in the nuclear reactor.

Q5. Where is Narora's atomic power station located?
(a) Andhra Pradesh
(b) Uttar Pradesh
(c) Madhya Pradesh
(d) None of the above
Answer: (b) Narora's atomic power station is located in Uttar Pradesh.
Answer:

Q6. What is nuclear chemistry?
Answer: Nuclear chemistry is the branch of chemistry that deals with the study of nuclear particles, nuclear forces and nuclear reactions. It began with the study of radioactivity.

Q7. Estimate the radius of $^{27}_{13}Al$ nuclei.
Answer: Here,
$R_o = 1.5 \times 10^{-15}$ m
Mass Number (A) = 27
So,
$r = R_o A^{⅓}$
$r = 1.5 \times 10^{-15} \times (27)^{⅓}$
$r = 1.5 \times 10^{-15} \times 3$
$r = 4.5 \times 10^{-15}$ m
$r = 4.5 \times 10^{-15}$ f

Q8. What is nuclear fusion?
Answer: A reaction in which two light nuclei combine to form a heavier nucleus accompanied by the release of energy is known as nuclear fusion. It can take place by allowing highly accelerated protons and deuterons to fall on the nuclei of the lighter elements.

Q9. What is nuclear power plant?
Answer: A nuclear power plant is a type of power plant used to generate electricity by using nuclear fission reactions.

Q10. What are the primary elements of a nuclear power plant?
Answer: A nuclear power plant is a type of power plant used to generate electricity by using nuclear fission reactions. The primary elements of a nuclear power plant are mentioned below.
1. Nuclear fuel consisting of fissionable material
2. Nuclear moderator
3. Nuclear reactor coolant
4. Nuclear control rods
5. Shield or containment system

Q11. What is nuclear fission?
Answer: The splitting of a heavy nucleus into two smaller fragments of approximately equal mass is known as nuclear fission.
$^{235}_{92} U + ^{1}_{0} n \rightarrow ^{90}_{38} Sr + ^{143}_{54} Xe + 3\ ^{1}_{0} n$

Q12. What are alpha beta and gamma rays?
Answer: Alpha rays: The rays deflected towards the negative plate and positively charged are known as alpha rays. These rays consist of merely helium nuclei.

Beta rays: The rays deflected toward the positive plate and are negatively charged are known as beta rays. These rays consist of mere electrons.
Gamma rays: The rays which are not deflected at all and are neutral are known as gamma rays.

Q13. The ratio of the mass of Pb^{206} to the mass of U^{238} in a certain rock specimen is 0.5. Assuming that the original rock contains no lead, estimate its age. Given the half-life of uranium is 4.5×10^9 years.

Answer:

We know that
$U^{238} = (U^{238} + Pb^{206}) e^{-\lambda t}$
Or
$1 = (1 + Pb^{206} / U^{238}) e^{-\lambda t}$
$1 = (1 + 0.5) e^{-\lambda t}$
$1 = 1.5 e^{-\lambda t}$
$e^{\lambda t} = 1.5$
$\lambda t = 2.3 \log_{10} 1.5$
$\lambda t = 2.3 \times 0.1761$
$(0.693 / 4.5 \times 10^9) \times t = 0.23 \times 0.1761$
$t = 2.63 \times 10^9$ years.

Q14. Match the following.

Column A	Column B
Nuclear fusion	**Fission and fusion**
Fission in a nuclear reactor	**$^{60}_{27}$ Co nucleus**
β Decay	**Absorption of thermal neutrons by $^{235}_{92}$ U**
γ ray emission	**Energy production in stars via hydrogen conversion to helium**

Answer:

Column A	Column B
Nuclear fusion	**Energy production in stars via hydrogen conversion to helium**
Fission in a nuclear reactor	**Absorption of thermal neutrons by $^{235}_{92}$ U**

β Decay	$^{60}_{27}$ Co nucleus
γ ray emission	Fission and fusion

Q15. How will you differentiate between nuclear fusion and nuclear fission?
Answer: We can distinguish between nuclear fusion and fission in the following ways.

S. No.	Nuclear Fusion	Nuclear Fission
1.	Nuclear fusion is defined as the combining of two lighter nuclei into a heavier one.	Nuclear fission is defined as the splitting of a nucleus into two daughter nuclei
2.	The energy released in the nuclear fusion reaction is much more than in the nuclear fission reaction.	A lot of energy is released in nuclear fission.
3.	Fusion reactions occur in stars and the sun.	Fission reactions do not occur naturally
4.	A large amount of energy is supplied in the nuclear fusion reaction.	Little energy is supplied in the nuclear fission reaction.
5.	Hydrogen bomb works on the principle of a nuclear fusion bomb.	The atomic bomb works on the principle of nuclear fission
6.	Hydrogen isotopes are the primary fuel used in power plants.	Uranium is the primary fuel used in power plants

Practise Questions on Nuclear Power Plant

Q1. What is radioactivity?

Answer: Radioactivity is a nuclear process that occurs due to the decay of the nucleus. Radioactivity is based on the law of conservation of charge. External parameters such as temperature and pressure do not affect the decay rate.

Q2. What is the significance of the nuclear study?

Answer: Nuclear energy is an essential part of society's energy production. Nuclear energy is produced using a nuclear reactor. In archaeology, nuclear solutions identify various stable and radioactive isotopes in artefacts.

Q3. Disseminate the reaction of the splitting of Plutonium-239 in a nuclear fission reaction.

Answer: $^{239}_{94}\mathrm{Pu} + ^{1}_{0}\mathrm{n} \rightarrow ^{137}_{54}\mathrm{Xe} + ^{40}_{103}\mathrm{Zr} + 3^{1}_{0}\mathrm{n}$

Q4. Disseminate the reaction of the splitting of Uranium-233 in a nuclear fission reaction.

Answer: $^{233}_{92}\mathrm{U} + ^{1}_{0}\mathrm{n} \rightarrow ^{137}_{54}\mathrm{Xe} + ^{94}_{38}\mathrm{Sr} + 3^{1}_{0}\mathrm{n}$

Q5. What happens when neutrons are bombarded on the uranium-235 atom?

Answer: When neutrons are bombarded on the uranium-235 atom, it splits into two lighter nuclei of krypton and barium.