PHYSICS

BOOKS - SELINA PHYSICS (ENGLISH)

RADIOACTIVITY

Examples

1. State two differences between a chamical change and a nuclear change.

Watch Video Solution

2. How is the radioactivity of an element affected when it undergoes a chemical change to form a chemical compound ? Give reason for your answer.

Watch Video Solution

3. Compare the ionising power of α, β and γ radiations.

Watch Video Solution

4. State the penetrating range in air for the α, β and γ radiations.

Watch Video Solution

5. State the nature of infrared and γ-rays. How do they differ in their (i) wavelength, and (ii) penetrating power ?

Watch Video Solution

6. State two similarities and two dissimilarities between the γ-rays and X-rays.

Watch Video Solution

7. Which of the radiations α, β and γ is similar to a beam of electrons ?

Watch Video Solution

8. (a) State three properties which are common to both the beta rays and cathode

rays.

(b) How do beta rays differ from cathode rays ?

Watch Video Solution

9. One isotope of uranium has a mass number 235 and atomic number 92.

(i) What is the number of electrons in the neutral atom of this isotope ?

(ii) What is the number of protons and number of neutrons in its nucleus ?

(iii) Do all isotopes have the same number of neutrons ?

(iv) What is the number of protons and neutrons in $^{238}_{92}U$?

Watch Video Solution

10. A certain nucleus P has a mass number 15 and atomic number 7.

(a) Find the number of neutrons.

(b) Write the symbol for the nucleus P.

(C) The nucleus P loses (i) one proton, (ii) one

β-particle, (iii) one α-particle. Write the symbol of the new nucleus in each case and express each change by a reaction.

Watch Video Solution

11. Uranium nucleus $^{238}_{92}U$ undergoes several disintegrations and ultimately decays to lead nucleus $^{206}_{82}Pb$. How many alpha and beta particles are emitted ?

Watch Video Solution

12. Complete the following nuclear changes :

$$ {}_{Z}^{A}X \xrightarrow{\beta} X_1 \xrightarrow{\gamma} X_2 \xrightarrow{\alpha} X_3 \xrightarrow{\beta} X_4 $$

Watch Video Solution

13. Complete the following nuclear changes :

$$ X \xrightarrow{\alpha} X_1 \xrightarrow{\gamma} X_2 \xrightarrow{\beta} X_3 \xrightarrow{\alpha} {}_{82}^{206}X_4 $$

Watch Video Solution

14. A radioactive sample is kept at the centre of an evacuated spherical vessel.

(a) Out of the α, β and γ radiations, name the radiations which are (i) safe and (ii) unsafe.

(b) Suggest two ways for more safety.

(c) Does evacuation of vessel help in safety ?

Watch Video Solution

15. (a) A mass of lead is embedded in a block of wood. Radiations from a radioactive source

incident on the side of block produce a shadow on a fluorescent screen placed beyond the block. The shadow of wood is faint, but the shadow of lead is dark. Give reason for the difference.

(b) If the block of wood is replaced by a block of aluminum, will there be any change in the shadow ?

Watch Video Solution

16. State one use and one harmful effect of radioactivity.

Watch Video Solution

17. Calculate the amount of energy released in MeV due to a loss of mass of 1 kg.

Watch Video Solution

18. Calculate the loss in mass equivalent to the energy $1.0 \times 10^6 kWh$.

Watch Video Solution

19. If in nuclear fission of a piece of uranium, 0.5 g mass is lost, how much energy in kWh is obtained?

Watch Video Solution

20. If 190 MeV energy is released due to fission of each nucleus of U-235, what mass of U-235 undergoes fission per hour in a reactor of power 300 MW ?

Take 1 a.m.u. $= 1.66 \times 10^{-27} kg$.

Watch Video Solution

21. In a nuclear fusion reaction, the loss in mass is 0.3%. How much energy is released in the fusion of 1 kg mass ?

Watch Video Solution

Exercise 12 A

1. Name the three constituents of an atom and state mass and charge of each. How are they distributed in an atom ?

Watch Video Solution

2. Define the following terms :

(a) atomic number, and (b) mass number.

Watch Video Solution

3. What is nucleus of an atom ? Compare its size with that of the atom. Name its constitutents. How is the number of these constituents determined by the atomic number and mass number of the atom ?

Watch Video Solution

4. State the atomic number and mass number of $^{23}_{11}Na$ and draw its atomic model.

Watch Video Solution

5. What are isotopes ? Give one example.

Watch Video Solution

6. (i) What are isobars?

(ii) Give one example of isobars.

Watch Video Solution

7. What is the name given to elements with same mass number and different atomic number ?

Watch Video Solution

8. Name the atoms of a substance having same atomic number, but different mass numbers. Give one example of such a

substance. How do the structures of such atoms differ ?

Watch Video Solution

9. What is meant by Radioactivity ?

Watch Video Solution

10. A radioactive substance is oxidised. What changes would you expect to take place in the nature of radioactivity ? Explain your answer.

Watch Video Solution

11. A radioactive source emits three type of radiations.

(a) Name the three radiations.

(b) Name the radiations which are deflected by the electric field.

(c) Name the radiation which is most penetrating.

(d) Name the radiation which travels with the speed of light.

(e) Name the radiation which has the highest

ionising power.

(f) Name the radiation consisting of the same kind of particles as the cathode rays.

Watch Video Solution

12. Answer the following questions.

(a) Name the radiation of zero mass.

(b) Name the radiation which has the lowest ionising power.

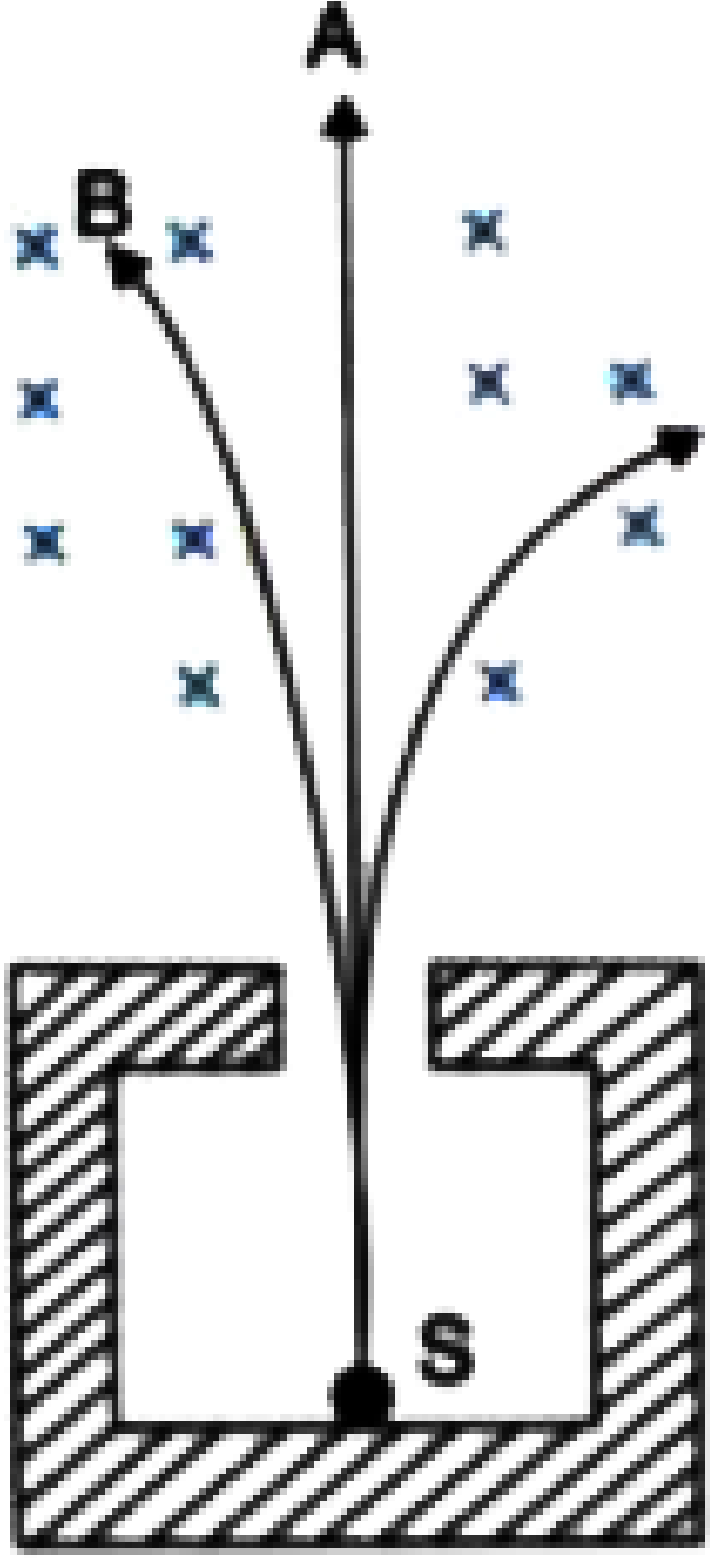
(c) Name the radiation which has the lowest penetrating power.

Watch Video Solution

13. The diagram in Fig. shows a radioactive source S placed in a thick lead walled container. The radiations given out are allowed to pass through a magnetic field (shown as X) acts perpendicular to the plane of paper inwards. Arrows show the paths of the radiations A, B and C.

(a) Name the radiations labelled A, B and C.

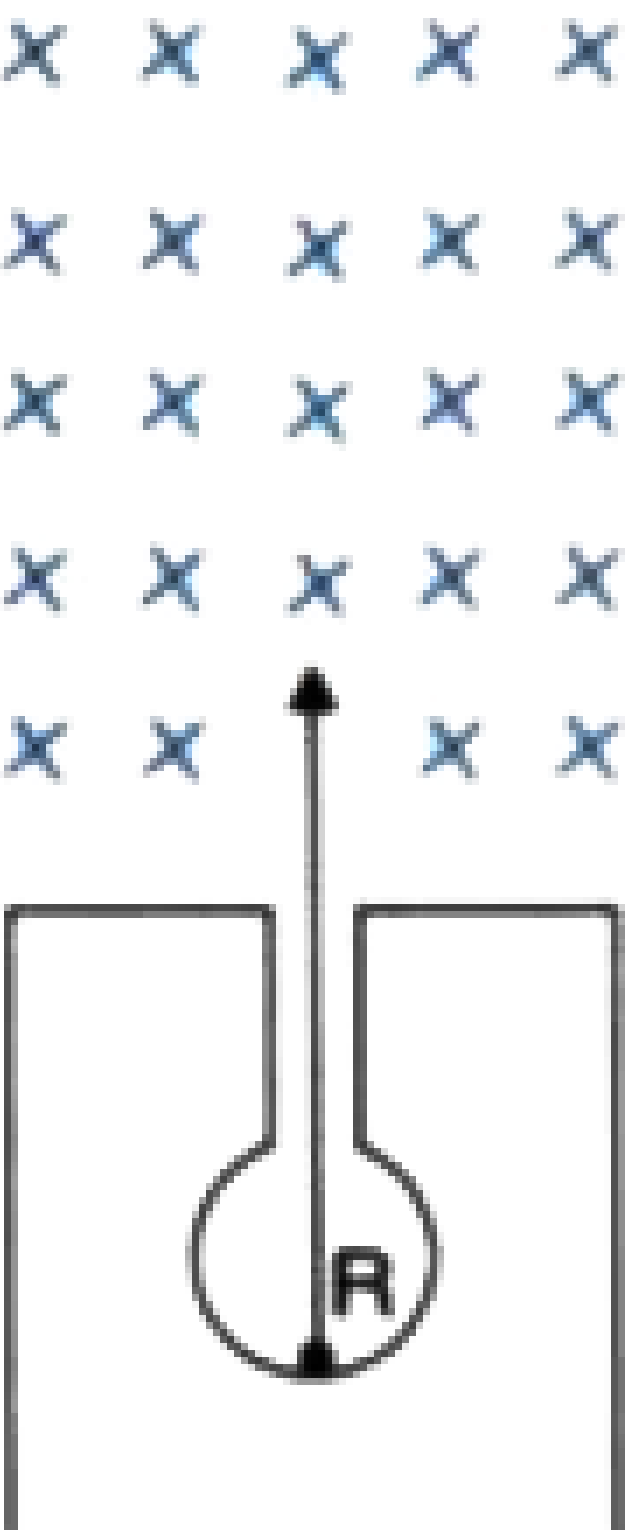
(b) Explain clearly how you used the diagram to arrive at the answer in part (a).


A
B
S

Watch Video Solution

14. Fig. 12.8 shows a mixed source R of alpha and beta particles in a thick lead walled container. The particles pass through a magnetic field in a direction perpendicular to the plane of paper inwards as shown by x. (a) Show in the diagram how the particles get affected. (b) Name the law used in part (a).

[Hint : alpha particles will deflect to the left while beta particles to the right]


R

Watch Video Solution

15. Explain why alpha and beta particles are deflected in an electric or a megnetic field, but gamma rays are not deflected in such a field.

[Hint : alpha and beta particles are changed, but gamma rays are uncharged]

Watch Video Solution

16. Explain why alpha and beta particles are deflected in an electric or a megnetic field, but gamma rays are not deflected in such a field.

[Hint : alpha and beta particles are changed, but gamma rays are uncharged]

Watch Video Solution

17. State following four properties each of α, β and γ radiations : (a) nature, (b) charge, (c) mass, and (d) effect of electric field.

Watch Video Solution

18. Compare the ionising power of α, β and γ radiations.

Watch Video Solution

19. State the speed of each of α, β and γ radiations.

Watch Video Solution

20. (a) What is the composition of α, β and γ radiations? (b) Can a hydrogen $\left({}_{1}^{1}H\right)$ nucleus emit an alpha particle ? (c) Which one α, β or γ radiation has the least penetrating power ?

Watch Video Solution

21. How are γ radiations produced ? Mention two common properties of the gamma radiations and visible light.

Watch Video Solution

22. An α-particle captures (i) one electron, (ii) two electrons. In each case, what does it change to ?

Watch Video Solution

23. Radioactivity is a nuclear phenomenon'. Comment on this statement.

Watch Video Solution

24. What kind of change takes place in a nucleus when a γ-particle is emitted ? Express it by an equation. State whether (a) atomic number, and (b) mass number are conserved in a radioactive γ-decay ?

Watch Video Solution

25. A certain radioactive nucleus emits a particle that leaves its mass number unchanged, but increases its atomic number

by one. Identify the particle and write its symbol.

Watch Video Solution

26. What happens to the (i) atomic number, (ii) mass number of the nucleus of an element when (a) an α-particle, (b) a β-particle, and (c) γ radiation, is emitted ?

Watch Video Solution

27. What happens to the position of an element in the periodic table when its nucleus emits (a) an α-particle, (b) a β-particle and (c) γ radiation ? Give reason for your answer.

Watch Video Solution

28. What changes occur in the nucleus of a radioactive element when it emits (a) an alpha particle, (b) a beta particle, (c) gamma

radiation ? Give one example, in each case (a) and (b) in support of your answer.

Watch Video Solution

29. An atomic nucleus A is composed of 84 protons and 128 neutrons. The nucleus A emits and alpha particle and is transformed into a nucleus B.

(i) What is the composition of B ?

(ii) The nucleus B emits a beta particle and is transformed into a nucleus C. What is the

composition of C?

(iii) What is mass number of the nucleus A ?

(iv) Does the composition of C change if it emits gamma radiations ?

Watch Video Solution

30. A certain nucleus A (mass number 238 and atomic number 92) is radioactive and becomes a nucleus B (mass number 234 and atomic number 90) by the emission of a particle.

(a) Name the particle emitted.

(b) Explain how you arrived at your answer.

(c) State the change in the form of a reaction.

Watch Video Solution

31. State whether the following nuclear disintegrations are allowed or not (star indicates an excited state). Give reason if it not allowed.

(a) ${}_{Z}^{A}X_{*} \rightarrow {}_{Z}^{A}X + \gamma$

(b) ${}_{Z}^{A}X \rightarrow {}_{Z-2}^{A}X + {}_{2}^{4}He$

Watch Video Solution

32. A nucleus $^{24}_{11}Na$ is β-radioactive.

(a) What are the numbers 24 and 11 called ?

(b) Write the equation representing β-decay.

(c) What general name is given to the product nucleus with respect to $^{24}_{11}Na$?

Watch Video Solution

33. A nucleus of stable phosphorus has 15 protons and 16 neutrons.

(a) What is its atomic number and mass number ?

(b) The nucleus of radio phosphorus has one neutron more than the stable nucleus. What will be its atomic and mass number ?

(c) What will be the atomic number and mass number of new nucleus formed by the decay of a β-particle by the radio phosporus in part (b) ?

Watch Video Solution

34. An element P disintegrates by α emission and the new element suffers two further disintegrations, both by β emission, to form an element Q. Explain the fact that P and Q are isotopes.

Watch Video Solution

35. A nucleus ${}_{Z}^{A}X$ emits 2 α particles and 1 β particle to form a nucleus ${}_{85}^{222}R$. Find the atomic number and mass number of X.

Watch Video Solution

36. Complete the following sentences :

(a) The mass number and atomic number of an element are not changed when it emits .....

(b) The atomic number of a radioactive element is not changed when it emits ..... (c) During the emission of a beta particle, the ..... number remains same.

Watch Video Solution

37. Complete the following nuclear changes :

(a) ${}_{x}^{a}P \rightarrow Q + {}_{-1}^{0}\beta$

(b) ${}_{92}^{238}U \rightarrow {}_{90}^{234}Th + \ldots . + energy$

(c) ${}_{92}^{238}P \xrightarrow{\alpha} Q \xrightarrow{\beta} R \xrightarrow{\beta} S$

(d) ${}_{Z}^{A}X \xrightarrow{\alpha} X_1 \xrightarrow{\gamma} X_2 \xrightarrow{2\beta} X_3$

(e) $X \xrightarrow{\beta} X_1 \xrightarrow{\alpha} X_2 \xrightarrow{\alpha} {}_{69}^{172}X_3$

Watch Video Solution

38. Name one radio isotope and state its use.

Watch Video Solution

39. Why are the alpha particles not used in radio therapy ?

[Hint : alpha particles cannot penetrate the human skin]

Watch Video Solution

40. Why do we usually use isotopes emitting gamma radiations as radioactive tracers in medical science ?

[Hint : gamma radiations are most penetrating]

Watch Video Solution

41. When does the nucleus of an atom tend to be radioactive ?

Watch Video Solution

42. Which of the following is the radio isotope in each pair (a) (b) and (c) ?

(a) ${}_{6}^{12}C,{}_{6}^{14}C$ (b) ${}_{15}^{30}P,{}_{15}^{32}P$ (c) ${}_{19}^{39}K,{}_{19}^{40}K$

Give reason for your answer.

Watch Video Solution

43. State the medical use of radioactivity.

Watch Video Solution

44. Arrange the α, β and γ radiation in ascending order of their biological damage. Give reason.

Watch Video Solution

45. Name two main sources of nuclear radiations. How are the nuclear radiations harmful ?

Watch Video Solution

46. State two safety measures to be taken while establishing a nuclear power plant.

Watch Video Solution

47. What is meant by nuclear waste ? State one way for the safe disposal of nuclear waste.

Watch Video Solution

48. State three safety precautions that you would take while handling the radioactive substances.

Watch Video Solution

49. Why should a radioactive substance not be touched by hand ?

Watch Video Solution

50. What do you mean by background radiations ? Name its two sources. Is it possible for us to keep ourselves away from it ?

Watch Video Solution

Multiple Choice Type

1. A radioactive substance emits radiations :

A. α, β and γ simultaneously

B. in the order α, β and γ one by one

C. X-rays and γ-rays

D. α or β.

Answer: A::B::D

Watch Video Solution

2. The electron emitted in beta radiation originates from

A. the outermost orbit of atom

B. the inner orbits of atom

C. the surface of substance

D. the nucleus of atom.

Answer: D

 Watch Video Solution

3. The least penetrating radiation is :

A. α-particles`

B. β-particles

C. X-rays

D. γ radiations.

Answer: A::C

Watch Video Solution

4. The radiation suffering the maximum deflection in a magnetic field is :

A. α-particles

B. β-particles

C. X-rays

D. γ radiations.

Answer: A::B::C

Watch Video Solution

5. The particle used in nuclear fission for bombardment is :

A. alpha particle

B. proton

C. beta particle

D. neutron.

Answer: D

Watch Video Solution

6. The temperature required for the process of nuclear fusion is nearly :

A. $1000K$

B. $10^4 K$

C. $10^5 K$

D. $10^7 K$

Answer: A::D

Watch Video Solution

Exercise 12 B

1. What do you mean by nuclear energy ? What is responsible for its release ?

Watch Video Solution

2. Write down the Einstein's mass-energy equivalence relation, explaining the meaning of each symbol used in it.

Watch Video Solution

3. (a) What is a.m.u ? Express 1 a.m.u. in MeV.

(b) Write the approximate mass of a proton, neutron and electron in a.m.u.

Watch Video Solution

4. What is nuclear fission ? Name the particle used for it. Write one fission reaction.

Watch Video Solution

5. (a) Name two isotopes of uranium which are fissionable.

(b) Which of the isotope mentioned in part (a) above is easily fissionable ? Give reason. (c) State whether the neutron needed for fission reaction of the isotope mentioned in part (b) above, is slow or fast ?

Watch Video Solution

6. Write the approximate value of the energy released in the fission of one nucleus of $^{235}_{92}U$. What is the reason for it ?

Watch Video Solution

7. Complete the following nuclear fission reactions :

(a) $^{235}_{92}U + ^{1}_{0}n \rightarrow _{56}Ba + ^{92}Kr + 3^{1}_{0}n + ...$

(b)

$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{148}La + ^{85}_{35}Br + ...^{1}_{0}n + energy$

Watch Video Solution

8. What do you mean by the chain reaction in nuclear fission ? How is it controlled ?

Watch Video Solution

9. State two uses of nuclear fission.

Watch Video Solution

10. Give two differences between the radioactive decay and nuclear fission.

Watch Video Solution

11. (a) What is nuclear fusion ? Give one example and write its nuclear reaction.

(b) What other name is given to nuclear fusion ? Give reason.

Watch Video Solution

12. Why is a very high temperature required for the process of nuclear fusion ? State the approximate temperature required.

Watch Video Solution

13. (a) Write one nuclear fusion reaction.

(b) State the approximate value of energy released in the reaction mentioned in part (a).

(c) Give reason for the release of energy stated in part (b).

Watch Video Solution

14. Complete the following fusion reactions :

(a) ${}_{2}^{3}He + {}_{1}^{2}H \rightarrow {}_{2}He + {}_{1}H + energy$

(b) ${}_{1}^{2}He + {}_{1}^{2}H \rightarrow {}_{2}He + {}^{1}n + energy$

Watch Video Solution

15. (a) Name the process, nuclear fission or nuclear fusion, in which the energy released per unit mass is more ?

(b) Name the process, fission or fusion which is possible at ordinary temperature.

Watch Video Solution

16. (a) State one similiarity in the process of nuclear fission and fusion.

(b) State two differences between the process of nuclear fission and fusion.

Watch Video Solution

17. Give two example of nuclear fusion.

Watch Video Solution

18. What is the source of energy of sun or stars ?

Watch Video Solution

19. Name the following nuclear reactions :

(a) $_{92}^{235} + _{0}^{1} n \rightarrow _{38}^{90} Sr + _{54}^{143} Xe + 3_{0}^{1} n + \gamma$

(b) ${}_{1}^{3}H + {}_{1}^{2}H \rightarrow {}_{2}^{4}He + {}_{0}^{1}n + {}_{0}^{1}n + \gamma$

Watch Video Solution

Numericals

1. In fission of one uranium-235 nucleus, the loss in mass is 0.2 a.m.u. Calculate the energy released.

Watch Video Solution

2. When four hydrogen nuclei combine to form a helium nucleus in the interior of sun, the loss in mass is 0.0265 a.m.u. How much energy is released ?

Watch Video Solution