PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 22

Total Marks : 58

Max. Time : 65 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective('–1'negative marking) Q.1 to Q.4,10,13	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.5 to Q.7	(4 marks, 4 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.8,11,12,14,15	(4 marks, 5 min.)	[20, 25]
Match the Following (no negative marking) (2 × 4) Q.9	(8 marks, 10 min.)	[8, 10]

1. The number of neutrons in the atom left after emission of 1 α-particle from $_{92}U^{238}$ is :

(A) 144 (B) 140 (C) 120 (D) 146

2. Which of the following is not a natural decay series :

(A) 4 n series (B) 4n + 1 series (C) 4n + 2 series (D) 4n + 3 series

3. $_{95}Am^{241}$ and $_{90}Th^{234}$ belong respectively to :

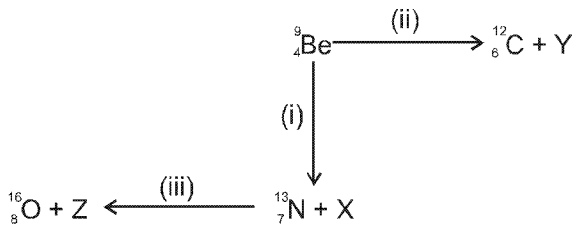
(A) 4n and 4n + 1 radioactive disintegration series

(B) 4n + 1 and 4n + 2 radioactive disintegration series

(C) 4n + 1 and 4n + 3 radioactive disintegration series

(D) 4n + 1 and 4n radioactive disintegration series

4. Bombardment by α-particle leads to artificial disintegration in three ways, (I), (II) and (III) as shown. Products **X**, **Y** and **Z** respectively are :



(A) β-particle, proton, positron (B) positron, neutron, proton

(C) β-particle, neutron, proton (D) positron, proton, neutron

5.* Decrease in atomic number is observed during :

(A) Alpha emission (B) Beta emission (C) Positron emission (D) Electron capture

6.* Atomic number of a radioactive element is 100. It first decays into an element Y, which then decays into Z. In both the processes, a charged particle is emitted. Which of the following can be true :

(A) Y has atomic number 102 (B) Y has atomic number 101

(C) Z has atomic number 100 (D) Z has atomic number 99

7.* Assuming that the charged particles emitted during natural decay of $_{92}U^{235}$ atoms are α and β particles only, which of the following products is/are not possible :

(A) $_{89}Ac^{231}$ (B) $_{89}Ac^{227}$ (C) $_{89}Ac^{225}$ (D) $_{82}Pb^{207}$

8. A radioactive element A decays as follows :

$$A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C \xrightarrow{-\beta} D$$

Identify the isotopes and isobars among A, B, C and D.

9.

	Column-I		**Column-II**
(i)	Velocity	**(p)**	$\alpha < \beta < \gamma$
(ii)	Ionisation power	**(q)**	$\alpha > \beta > \gamma$
(iii)	Penetrating power	**(r)**	$\gamma < \beta < \alpha$
(iv)	mass	**(s)**	$\gamma > \beta > \alpha$

10. ^{23}Na is more stable isotope of Na. Find out the process by which $^{24}_{11}Na$ can undergo radioactive decay :

(A) β^- emission (B) α emission (C) β^+ emission (D) K electron capture

11. $_{92}X^{234} \xrightarrow[-6\beta]{-8\alpha}$ Y. Find out atomic number & mass number of Y and identify it.

12. Complete the following equations :

(a) $^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{87}_{38}Sr + ^{147}_{54}Xe + ...$

(b) $^{84}_{34}Se \longrightarrow ..... + 2\ ^{0}_{-1}e$

13. A positron is emitted from $^{23}_{11}Na$. The ratio of the mass number and atomic number of the resulting nuclide is:

(A) 22/10 (B) 22/11 (C) 23/10 (D) 23/12

14. The total number of α and β particles emitted in the nuclear reaction $^{238}_{92}U \rightarrow ^{214}_{82}Pb$ is :

15. The number of neutrons emitted when $^{235}_{92}U$ undergoes controlled nuclear fission to $^{142}_{54}Xe$ and $^{90}_{38}Sr$ is :

Answer Key

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1.	(A)	**2.**	(B)	**3.**	(B)	**4.**	(C)
5.*	(ACD)	**6.***	(BCD)	**7.***	(AC)		

8. A and D are isotpes. B, C and D are isobars.

9. (i) p,s (ii) q,r (iii) p,s (iv) q,r

10. (A) **11.** $_{82}Y^{206}$; (Atomic no. 82, Mass no. 206), Pb

12. (a) $2\ ^{1}_{0}n$, (b) **13.** (C) **14.** 8 **15.** 3

Hints & Solutions

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8. A and D are isotpes. B, C and D are isobars.

9. **(i) p,s (ii) q,r (iii) p,s (iv) q,r**

10. Isotopic ($_{11}Na^{24}$) is less stable than $_{11}Na^{23}$ because it show radioactive decays. (Less stability of Na^{24} w.r.t. Na^{23} is also based upon $\frac{13}{11}\left(\frac{n}{p}\right)$. Higher value of $\frac{n}{p}$, higher will be unstability so it is disintegrated to attain the stability).

$$_{11}Na^{24} \longrightarrow {}_{11}Na^{23} + {}_{0}n^{1}$$

Less stable stable neutron

This neutron on decomposition to give proton and β^- particle ($_{-1}e^0$)

$$_{0}n^{1} \longrightarrow {}_{1}H^{1} \text{ or } {}_{1}p^{1} + {}_{-1}e^{0}$$

Proton (β^- particle)

Hence, isotopic sodium is changed into sodium by means of emission of β^- emission.

11. (i) The atomic mass of an element reduces by 4 and atomic number by 2 on emission of an α-particle.

(ii) The atomic mass of an element remains unchanged and atomic number increses by 1 on emission of a β-particle.

Thus change in atomic mass on emission of 8α–particles will be $8 \times 4 = 32$

New atomic mass = old atomic mass – 32 = 238 – 32 = 206

Similarly change in atomic number on emission of 8α-particle will be : $8 \times 2 = 16$

i.e., New atomic number = old atomic number – 16 = 92 – 16 = 76

On emission of 6β-particles the atomic mass remains unchanged thus, atomic mass of the new element will be 206.

The atomic number increases by 6 unit thus new atomic nubmer will be $76 + 6 = 82$

Thus, the equation looks like : $_{92}X^{238} \xrightarrow[-6\beta]{-8\alpha} {}_{82}Y^{206}$

12. (a) $^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{87}_{38}Sr + {}^{147}_{54}Xe + 2{}^{1}_{0}n$

(b) $^{84}_{34}Se \longrightarrow {}^{84}_{36}Kr + 2\ {}^{0}_{-1}e$

13. $^{23}_{11}Na \longrightarrow {}^{23}_{10}Ne + {}^{0}_{+1}e$; So ratio of atomic mass and atomic number = $\frac{23}{10}$.

14. $^{238}_{92}U \longrightarrow {}^{214}_{82}Pb + 6({}^{4}_{2}He) + 2({}_{-1}e^{0})$

$\alpha = 6, \beta = 2$

Total = 8

15. $^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{142}_{54}Xe + {}^{90}_{38}Sr + 4\ {}^{1}_{0}n$

(slow neutron)