Shiksha Classes Bhandara
CHAPTER TEST

Subject : Physics **Topic : Modern Physics** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 Rank the following nuclei in descending order (greatest first) according to density of each nucleus:
$^{12}_{6}C$, $^{120}_{50}Sn$, $^{239}_{94}Pu$

(A) $^{12}_{6}C$, $^{120}_{50}Sn$, $^{239}_{94}Pu$

(B) $^{120}_{50}Sn$, $^{239}_{94}Pu$, $^{12}_{6}C$

(C) $^{120}_{50}Sn$, $^{12}_{6}C$, $^{239}_{94}Pu$

(D) All the nuclei have approximately the same density.

Q.2 Which one or more of the three decay processes (α ,β^-, or γ) results in a new element?

(A) α and β^- (B) Only α

(C) Only β^- (D) β^- and γ

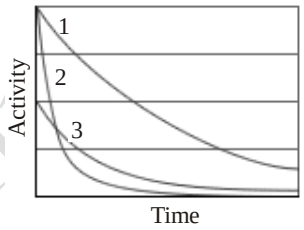
Q.3 If the mass of a radioactive substance is increased, do the activity, the decay constant, and the half-life, increase, decrease, or remain the same?

	Activity	Decay constant	Half life
a	Remains the same	Increases	Decreases
b	Increases	Increases	Decreases
c	Increases	Remains the same	Remains the same
d	Decreases	Remains the same	Increases

(A) a (B) b

(C) c (D) d

Q.4 The figure shows the activities of three radioactive samples Rank the samples according to their half-life, largest first.



(A) 2, 3, 1 (B) 1, 2, 3

(C) 3, 2, 1 (D) 1, 3, 2

Q.5 Our bodies are mostly made of hydrogen (Z = 1), carbon (Z = 6), and oxygen (Z = 8). In our bodies, are there many more neutrons than protons, many fewer neutrons than protons, or are there about the same number of each?

(A) There are many more neutrons than protons.

(B) There are many fewer neutrons than protons.

(C) There are about the same number of neutrons and protons.

(D) One cannot answer this question from the given information.

Q.6 A particle of mass m is projected from ground with velocity u making angle θ with the vertical. The de-Broglie wavelength of the particle at the highest point is –

(A) ∞ (B) $\frac{h}{mu\sin\theta}$

(C) $\frac{h}{mu\cos\theta}$ (D) $\frac{h}{mu}$

Q.7 Two samples contain different radioactive isotopes. Is it possible for these samples to have the same activity?

(A) Yes, because they can have the same number of nuclei, but different half-lives.

(B) Yes, because they can have different numbers of nuclei and different half-lives.

(C) Yes, because they can have different numbers of nuclei, but the same half-lives.

(D) No, because they can have different half-lives.

Q.8 A ultra violet photon and an electron have the same de Broglie wavelengths, then the energy of the photon is –

(A) greater than the kinetic energy of the electron

(B) less than the kinetic energy of the electron

(C) equal to the kinetic energy of the electron

(D) none of the above

Q.9 An electron in hydrogen atom first jumps from second excited state to first excited state and then from first excited state to ground state. Let the ratio of wavelength, momentum and energy of photons emitted in these two cases be a, b and c respectively. Then

(i) c = 1/a (ii) a = 9/4

(iii) b = 5/27 (iv) c = 5/27

Correct options are –

(A) i, iii, iv (B) i, ii, iii

(C) ii, iii, iv (D) ii, iii

Q.10 If first excitation potential of a hydrogen like atom is V electron volt, then the ionization energy of this atom will be –

(A) V electron volt.

(B) 3V/4 electron volt.

(C) 4V/3 electron volt.

(D) cannot be calculated by given information.

Q.11 How long will it take for a radioactive sample to decrease to 10%, it its half life is 22 years?

(A) 80 years (B) 73 years

(C) 90 years (D) 60 years

Q.12 In a photoelectric experiment, with light of wavelength λ, the fastest electron has speed v. If the exciting wavelength is changed to $3\lambda/4$, the speed of the fastest emitted electron will become –

(A) $v\sqrt{\frac{3}{4}}$ (B) $v\sqrt{\frac{4}{3}}$

(C) less than $v\sqrt{\frac{4}{3}}$ (D) greater than $v\sqrt{\frac{4}{3}}$

Q.13 1..5 mW of 400 nm light is directed at a photoelectric cell. If 0.10% of the incident photons produce photoelectrons, the current in the cell is –
(A) 0.36 μA (B) 0.48 μA
(C) 0.42 mA (D) 0.32 mA

Q.14 Consider applying the Bohr model to a neutral helium atom (Z = 2). The model takes into account a number of factors. Which one of the following does it not take into account?
(A) The quantization of the orbital angular momentum of an electron.
(B) The centripetal acceleration of an electron.
(C) The electric potential energy of an electron.
(D) The electrostatic repulsion between electrons.

Q.15 A photon is emitted by a hydrogen atom when it comes from excited state n = 5 to the ground state. The recoil speed is almost
(A) 10^{-4} m/sec (B) 2×10^{-2} m/sec
(C) 4 m/sec (D) 8×10^{2} m/sec

Q.16 Which element has a K_α x-ray line whose wavelength is 0.180 nm ?
(A) cobalt (B) Xenon
(C) Copper (D) Iron

Q.17 The threshold wavelength of the tungsten is 2300 Å. If ultraviolet light of wavelength 1800 Å is incident on it, then the maximum kinetic energy of photoelectrons would be about –
(A) 1.49 eV (B) 2.2 eV
(C) 3.0 eV (D) 5.0 eV

Q.18 An ultraviolet light bulb, emitting 400 nm and an infrared light bulb, emitting at 700nm, each are rated at 130 W. Then the ratio of the number of photons emitted per second by the UV and IR sources is –
(A) 0.57 (B) 1.75
(C) 28 (D) 0.04

Q.19 In a Coolidge tube, the minimum wavelength of the x-rays coming out is 2Å. Then the operating voltage of the tube is –
(A) 6.2 KV (B) 62 KV
(C) 24.8 KV (D) 2.48 KV

Q.20 The K_α line obtained for molybdenum (Z = 42) target is 0.71 Å. Then, the wavelength of the K_α line of copper (Z = 29) is –
(A) 2.14 Å (B) 1.52 Å
(C) 1.04 Å (D) 0.71 Å

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 In a hydrogen atom following the Bohr's postulates the product of linear momentum and angular momentum is proportional to $(n)^x$ where 'n' is the orbit number. Then 'x' is-

Q.22 If the stationary proton and α-particle are accelerated through same potential difference, the ratio of de Broglie's wavelength will be $(1/\sqrt{X})$. Find the value of X.

For Q.23-Q.25

In hydrogen like atoms in which every atom is in a particular excited state. Now a stream of photons of energy $\frac{64}{225}E_0$ bombarded into it and is absorbed by the hydrogen like atoms and subsequently its emission spectrum shows 10 different lines in which some lines have energy less than $\frac{64}{225}E_0$ and some lines energy more than $\frac{64}{225}E_0$ and some lines have energy equal to $\frac{64}{225}E_0$. (Where E_0 is ionization energy of hydrogen atom in ground state)

Q.23 The initial quantum no. of electron in the atom is –

Q.24 The final quantum no. of electron in the atom is –

Q.25 Atomic no. of the atom is –