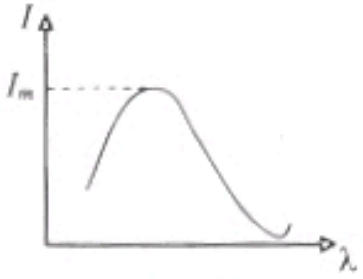
Physics English Classified MCQ Matter & Radiation 1992 - 2016

MATTER & RADIATION

01. Radiation

1) Figure shows the variation of the intensity of radiation I emitted by a black body with the wavelength λ. As the temperature of the black body increases the maximum intensity,



1) I_m increases and the position of I_m shifts towards longer wavelengths.
2) I_m increases and the position of I_m shifts towards shorter wavelengths
3) I_m decreases and the position of I_m shifts towards longer wavelengths
4) I_m decreases and the position of I_m shifts towards shorter wavelengths
5) I_m remains constant and the position of I_m shifts towards shorter wavelengths

(1997)

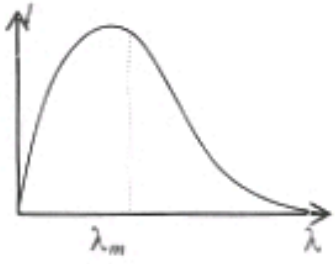
2) The sun radiates energy at the rate of E per unit surface area. Assuming the sun to be a black body. Its surface temperature is given by (σ = Stefan constant)

(1) $\left(\frac{E}{\sigma}\right)^{1/4}$ (2) $\left(\frac{E}{\sigma}\right)^{1/2}$ (3) $\frac{E}{\sigma}$ (4) $\left(\frac{E}{\sigma}\right)^{2}$ (5) $\left(\frac{E}{\sigma}\right)^{4}$ (1999)

3) Unit of Planck constant (h) is,

(1) Js^{-1} (2) Js (3) Js^{-2} (4) $J^{-1}s$ (5) $J^{-1}s^{-1}$ (1999)

4) Figure shows the black body radiation curve for a body at a given temperature. Consider the following statements.



At a hugger temperature

(A) λ_m would be lower

(B) intensity would be higher

(C) velocity of the 4 emitted radiation would be higher.

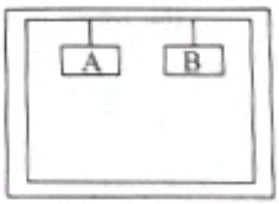
Of the above statements

(1) Only (A) is true (2) Only (B) is true

(3) Only (A) and (C) are true (4) Only (B) and (C) are true

(5) all (A), (B) and (C) are true (2002)

5) Two blocks A and B initially at 800^0C and room temperature (30^0C) respectively are hung from insulated strings in an evacuated and conducting enclosure which is at room temperature. The enclosure is insulated from outside. Which of the following statements is correct prior to the system being reached equilibrium?



(1) Temperatures of A, B and the enclosure remain und changed

(2) Enclosure remains at room temperature but the temperatures of A and B change

(3) temperatures of the c\enclosure and the block B increase, but that of block A decreases.

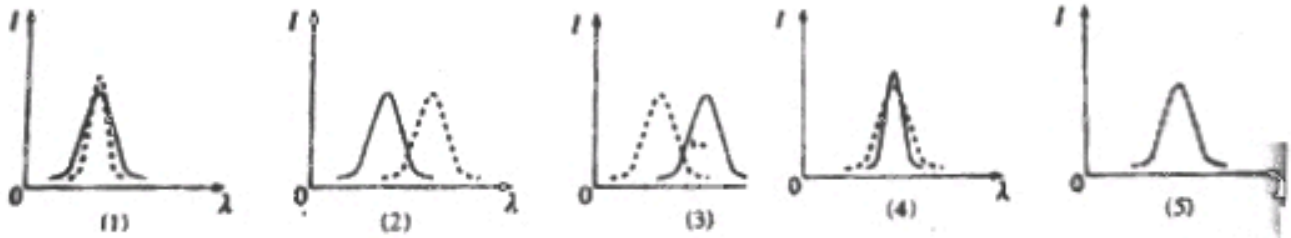
(4) Temperature of the enclosure increases but that of A and B remain unchanged.

(5) Temperatures of A and B decrease but that of enclosure increases. (2003)

6) A, B, C and D are four cups of same size. A and B have rough black surfaces and C and D have smooth shining surfaces. A and C are filled with hot tea at 50^0C and B and D are filled with cold tea at 10^0C . If the room temperature is 30^0Cwhich of the following is true?

(1) A cools faster than C, and B warms faster than D
(2) A cools slower than C, and B warms faster than D
(3) A and C cool at the same rate, and B warms faster than D
(4) A cools slower than C, and B warms slower than D
(5) A cools faster than C and B warms slower than D (2003)

7) A star (S) rotates about its own axis as shown in the figure. Which of the following graphs best represents the observed distribution of intensity (I) as a function for wavelength (λ) of a spectral line emitted by a certain gas in the star, when viewed from the earth (E)? The broken lines represents the expected intensity distribution of the specked line if the expected intensity distribution of the spectral line if the star does not rotate about its axis.



(2006)

8) A black body of temperature T. K radiators energy is a tube of 10mW. At temperature 2% K is will decrease energy at a rube of,
1) 10 mW 2) 20 m W 3) 40 mW 4) 80 mW 5) 160 mW (2006)

9) Two ideal gases A and B having same value for the ratio of principal special heat capacities are kept at the same temperature. Mass of a molecule of gas A is four times the mass of a molecule of gas B.

The ratio $\frac{\text{velocity of sound in gas A}}{\text{Velocity of sound in gas B}}$ is equal to

1) $\frac{1}{4}$ 2) $\frac{1}{2}$ 3) 1 4) 2 5) 4 (2008)

10) If the absolute value of the surface temperature of the sun were three times the existing value, the radiation of the would have been mostly in,
1) microwave range 2) infrared range 3) visible range
4) X – ray range 5) ultraviolet range (2009)

11) A cylindrical copper block of radius r and length $l = 2r$ radiates energy as a black body at temperature T. If this copper block is cut and separated into N identical disks having the same radius r, the rate of the emission of radiant energy at the above temperature will increase by a factor of,

1) $\frac{(N+3)}{3}$ 2) $\frac{(N+2)}{3}$ 3) $\frac{(N+1)}{3}$ 4) $\frac{N}{3}$ 5) N (2014)

12) When the body temperature of a person is 35°C, the peak wavelength of the radiation emitted from the body occurs at 9.4 μm. If his body temperature increases to 39°C, the peak wavelength will be (Assume that the black body radiation conditions can be applied.)

1) $\frac{35}{39} \times 9.4$ μm 2) $\frac{39}{35} \times 9.4$ μm 3) $\frac{77}{78} \times 9.4$ μm

4) $\frac{78}{77} \times 9.4$ μm 5) $\left(\frac{78}{77}\right)^4 \times 9.4$ μm (2016)

02. Photoelectric effect

1) Consider the following statements made about the photoelectric effect.

A) Number of electrons emitted increases with the intensity of the incident light

B) Maximum velocity of the electrons emitted increase with the intensity of the incident light

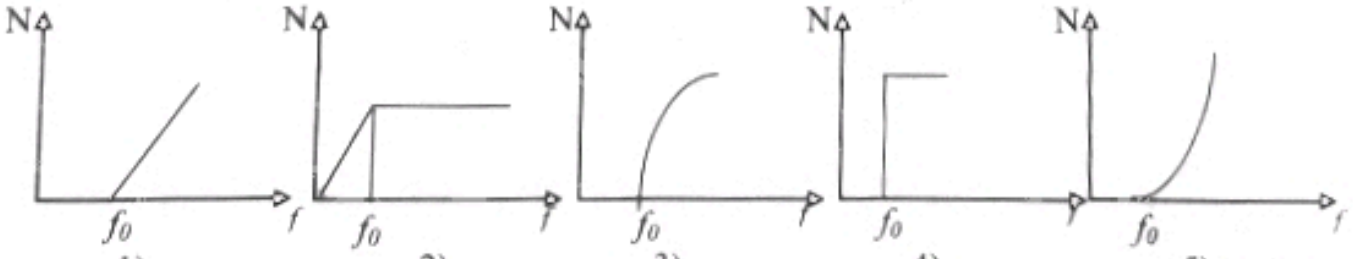
C) Maximum velocity of the electrons emitted increases with the wavelength of the incident light.

Of the above statements

1) Only A is true 2) Only B is true 3) Only C is true

4) Only A and B are true 5) Only A and C are true (1998)

2) A light beam is incident on a photosensitive surface. If the intensity of the incident beam is not changed which of the following graphs best represents the variation of number (N) of electrons emitted per second with the frequency (f) of the incident light (f_0 represents the threshold frequency of the photosensitive material)



1) 2) 3) 4) 5)(2000)

3) Electrons are emitted from a certain metal when a monochromatic light of wavelength λ is incident on it, h is the Planck constant and c is the velocity of light. Consider the following statements

A) Kinetic energy of electrons emitted from the metal is less than $hc\lambda$.

B) Kinetic energy of electrons emitted from the metal does not depend on the material of metal

C) Rate of emission of electrons depends on the wavelength λ

Of the statements

1) Only (A) is true
2) Only (A)and (B) are true
3) Only(A) and (C) are true
4) Only (B) and (C) are true
5) all (A), (B) and (C) are true

(2001)

4) A monochromatic beam of light is falling on a photosensitive surface. An increase in the intensity of the beam

1) will increase the rate of emission of electrons
2) will decrease the rate of emission of electrons
3) will increase the energy of emitted electrons
4) will decrease the energy of emitted electrons
5) will not change the energy and the rate of emission of electrons (2002)

5) A metal plate is illuminated with a beam of light of a certain frequency which of the following determines whether the electrons are emitted or not from the metal surface?

1) The intensity of the light
2) The length of the time of exposure to the light
3) The surface area of the plate
4) The type of the metal
5) The speed of the incident photons

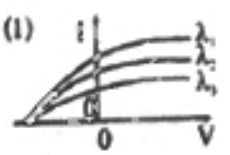
(2003)

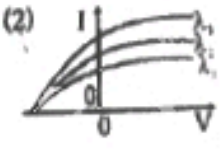
6) Which of the following responses contains false information regarding photons and electrons?

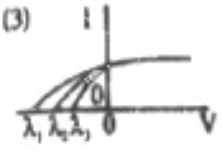
	Photons	Electrons
(1)	Cannot travel at different speeds in a vacuum	Can travel at different speeds in a vacuum
(2)	Can have different energies	Can have different energies
(3)	Can be deflected by electric fields	Can be deflected by electric and magnetic fields
(4)	Can behave as particles and waves	Can behave as particles and waves
(5)	Can eject electrons from materials	Can eject photons from materials

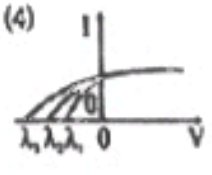
(2004)

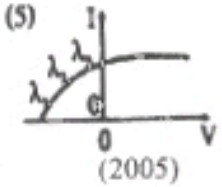
7) A photosensitive surface is illuminated separately by light of wavelengths λ_1, λ_2 and λ_3 ($\lambda_1 > \lambda_2 > \lambda_3$). On all three occasion the intensity (number of photons incident per second) of the light used is kept at the same value. The current – voltage characteristic of the photo electrons for the three situation are best represented by,

(1) 

(2) 

(3) 

(4) 

(5) 

(2005)

8) Light of wavelength 5000 $\overset{0}{A}$ is incident on a sodium surface whose work function is 2.28 eV. The maximum kinetic energy of the emitted photoelectron is

($hc = 12.4 \times 10^3$ eV $\overset{0}{A}$)

1) 0.03 eV 2) 0.20 eV 3) 0.60 eV 4) 1.30 eV 5) 2.00 eV (2006)

9) Consider the following statements made regarding the photoelectric effect.

A) This effect can be explained by assuming light as energy packets.

B) For a given incident monochromatic light, the energy of emitted electrons does not depend on the material.

C) Rate of emission for electrons depends on the intensity of the incident light.

Of the above statements,

1) only (A) and (B) are true.
2) only (B) and (C) are true.
3) only (A) and (C) are true.
4) all (A), (B) and (C) are true.
5) all (A), (B) and (C) are true (2007)

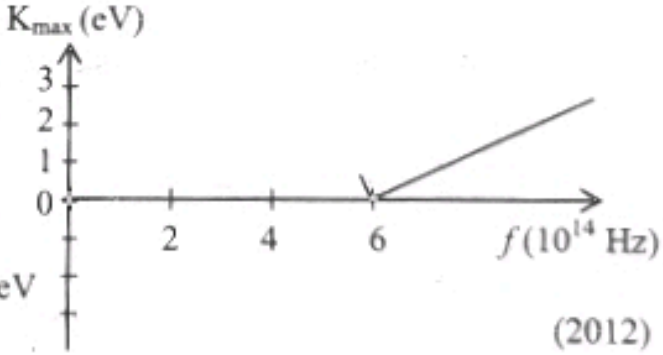
10) Blue and red light falling on a certain photocathode produce photoelectrons.

1) Maximum kinetic energy of the emitted photoelectron is higher for blue light.
2) Stopping potential is higher for red light.
3) Work function of the material of the photocathode is higher for blue light.
4) Number of emitting photoelectrons is always higher for blue light.
5) Stopping potential is same for both colours. (2008)

11) A metal plate is illuminated with light of a certain frequency. Which of the following determines whether electrons are emitted or not from the plate?

1) The intensity of the light.
2) Time of exposure of the plate to the light.
3) The thermal conductivity of the material of the plate.
4) The area of the plate.
5) The material of which the plate is made. (2009)

12) The graph shows the variation of the maximum kinetic energy (K_{max}) of emitted proto electrons from a metal with the frequency (f) of the incident radiation. The work function of the metal is,



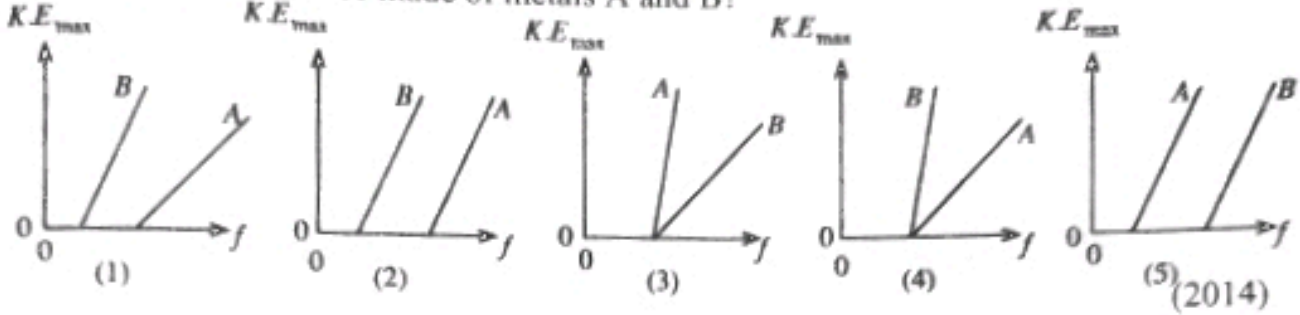
1) 6.0 eV 2) 4.0 eV 3) 2.5 eV
4) 2.0 eV 5) 1.0 eV (2012)

13) Electromagnetic radiation of frequency f is incident on a photosensitive surface of which threshold frequency for emission of photoelectrons is f_0

Which of the following is not true?

1) No photoelectrons are emitted when $f < f_0$
2) f_0 is a characteristic feature of the material of the photosensitive surface.
3) When $f > f_0$, the rate of the emission of photoelectrons increases as the intensity of incident radiation increases.
4) The stopping potential is directly proportional to f^2.
5) The stopping potential is independent of the intensity of the incident radiation. (2013)

14) The work functions corresponding to two metals A and B are W_1 and W_2 respectively, and $W_1 > W_2$. Two surfaces made of A and B are illuminated separately using a monochromatic beam of light of frequency f. Which of the following graphs correctly represents the variation of the maximum kinetic energy (K. E_{max}) of the emitted photoelectrons with the frequency (f) of the incident light beam, for the surface made of metals A and B?



(2014)

15) A, B and C are three metals with threshold wavelengths $\lambda_A = 0.3\mu m$, $\lambda_B = 0.28\mu m$ and $\lambda_C = 0.20\mu m$ respectively for photoelectric emission. Photons of frequency 1.2×10^{15}Hz are incident on each of the metals. Photoelectrons are emitted (The speed of light in vacuum is $3\times10^{8}\,ms^{-1}$)

1) only from A
2) only from B
3) only from C
4) only from A and B
5) from all A , B and C.

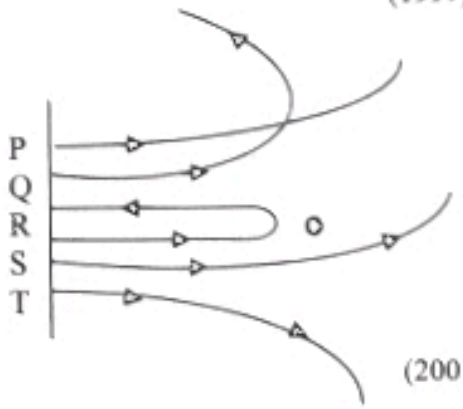
(2015)

03. Particles and Waves

1) Which of the following statements made about X – rays is not true?
1) In vacuum X-rays propagate with the speed of light.
2) X-rays can be diffracted by a crystal lattice.
3) X-rays can produce photoelectric effect.
4) X-rays can be deflected by electric or by magnetic fields.
5) X-rays can ionize a gas

(1997)

2) A proton is fired at an atomic nucleus (X). Which one of the paths shown in the diagram is not possible for the proton?
1) P
2) Q
3) R
4) S
5) T



(2001)

3) When a free particle with kinetic energy K and de Broglie wavelength λ enters a certain region its potential energy becomes V. The particle's new de Broglie wavelength is given by,

1) $\lambda\sqrt{\frac{V}{V-K}}$ 2) $\lambda\sqrt{\frac{V}{K-V}}$ 3) $\lambda\left(1+\frac{K}{V}\right)$ 4) $\lambda\left(1-\frac{K}{V}\right)$ 5) $\lambda\sqrt{\frac{V}{V+K}}$ (2010)

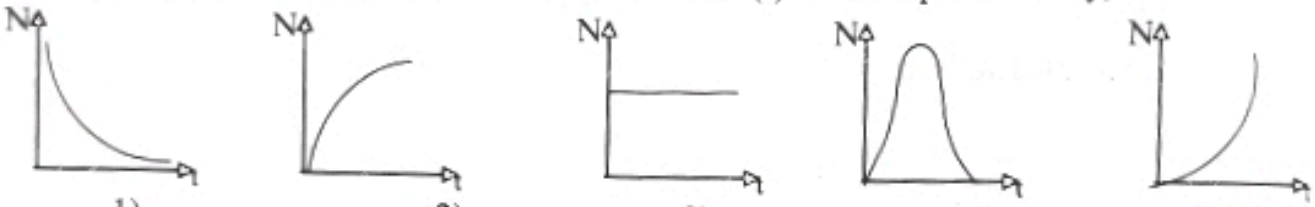
4) When a beam of 100 keV electrons is stopped in a metal target, it produces,
1) β^- particles 2) β^+ particles 3) α particles 4) neutrons 5) X rays (2011/N)

5) An electron of mass m_e, when accelerated through a potential difference has a de Broglie wavelength λ. The de Broglie wavelength associated with a proton of mass m_p accelerated through the same potential difference would be
1) $\lambda\sqrt{\frac{m_p}{m_v}}$ 2) $\lambda\sqrt{\frac{m_v}{m_p}}$ 3) $\lambda\frac{m_v}{m_p}$ 4) $\lambda\frac{m_p}{m_v}$ 5) $\frac{\lambda m_v^2}{m_p^2}$ (2011/N)

04. Radioactivity

1) Which one of the following statements made about X-rays and γ-rays in not true?
1) γ-rays have shorter wavelengths than X-rays
2) γ-rays photons are charged whereas X-ray photons are neutral
3) γ-ray the more penetrating power than X-rays
4) Both γ and X-ray travel with the speed of light in vacuum
5) Both X-rays and γ-rays can be diffracted. (1998)

2) In a radioactive sample, nuclei A decay to a stable nuclei B. The variation of the number of atoms (N) of B formed with time (t) is best represented by,



1) 2) 3) 4) 5)(1998)

3) Which one of the following properties is not a common one of all three α, β and γ radiations?
1) Carrying energy
2) Show particle as well as wave nature
3) Ability of ionizing air
4) Being emitted by the nucleus of an atom
5) Having a charge
(1999)

4) An isotope of uranium, $\frac{239}{92}U$. Decays by the emission of a β particle, which of the following responses gives the correct mass number and atomic number for the new nucleus formed?

	Mass Number (A)	Atomic Number (Z)
(1)	235	90
(2)	240	92
(3)	239	91
(4)	239	93
(5)	239	90

(1999)

5) A Geiger counter can be used to detect
A) α particles B) γ rays C) neutrons
1) only (A) is true 2) Only (B) is true 3) Only (C) is true
4) Only (A) and (B) are true 5) all (A), (B) and (C) are true (2000)

6) A radioactive element ${}^{A}_{86}X$ decays to a stable element ${}^{206}_{82}Y$ after several α – emissions. The value of A is
1) 206 2) 208 3) 210 4) 212 5) 214 (2000)

7) Radioactive ${}^{90}_{234}$Th the nucleus emits two β⁻ emissions followed by an α emission. The resulting nucleus will have,
1) 86 protons and 140 neutrons
2) 88 protons and 140 neutrons
3) 90 protons and 140 neutrons
4) 90 protons and 142 neutrons
5) 96 protons and 142 neutrons (2001)

8) A fossil is found to be 72,000 years old by carbon -14 dating. If the half life of ${}^{14}C$ is 6,000 yrs, the ratio $\frac{\text{amount of 14C present in the fossil}}{\text{amount of 14C present in living tissue}}$ is,
1) $\frac{1}{2}$ 2) $\frac{1}{2^3}$ 3) $\frac{1}{2^5}$ 4) $\frac{1}{2^{12}}$ 5) $\frac{1}{2^{16}}$ (2001)

9) A radioactive nucleus ${}^{A}_{Z}X$ decays by emission of an α – particle followed by a γ ray. The daughter nucleus thus formed has a mass number and atomic number.
1) A – 5 and Z – 2 respectively
2) A – 4 and Z – 2 respectively
3) A – 5 and Z – 3 respectively
4) A – 4 and Z – 3 respectively
5) A – 4 and Z respectively (2002)

10) If the mass of a radioactive sample is doubled. Which of the following is correct, regarding its activity and its half – life

	Activity	Half life
1)	Increases	Increases
2)	Increases	Decreases
3)	Increases	Remains the same
4)	Remains the same	Remains the same
5)	Remains the same	Decreases

(2003)

11) The variation of rate of decay (A) of a radioactive sample with time (t) is given by the relationship $A = A_0 e^{-\lambda t}$. The dimension of λ is,
1) T 2) T^{-1} 3) MT 4) $M^{-1}T$ 5) MT^{-1} (2005)

12) Consider the following statements regarding α and β particles.
(A) Both α and β particles travel with the speed of light.
(B) Generally α particles penetrate deeper into materials than β particles.
(C) Both α and β particles can ionize atoms what they travel through materials.
Of the above statements,
1) only (A) is true.
2) only (C) is true.
3) only (B) and (C) are true.
4) only (A) and (C) are true
5) only (A) and (B) are true. (2005)

13) The radioactive nucleus ${}^{A}_{Z}X$ decade to ${}^{A-4}_{Z-1}Y$ in two stages. The radiation counted is the two stages would most likely be,

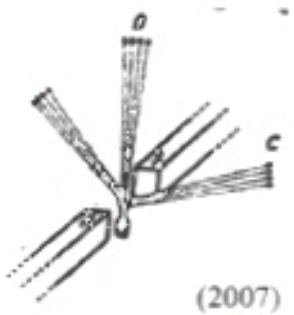
	first stage	second stage
1)	α	β^-
2)	β^-	γ
3)	β^+	α
4)	α	γ
5)	β^+	γ

(2006)

14) An archeological extracted 100 mg of carbon from an ancient wooden tool and round it is $\frac{1}{4}$ as radioactive as 100 mg of carbon extracted from a live tree. Half – life of carbon – 14 is 5730 years. How old is the wooden tool ?

1) 1432.5 years 2) 5730 years 3) 10,162.5 years
4) 11,460 years 5) 22, 920 years (2007)

15) A radiactive source is placed at the bottom of a hole in a lead block. The beam of radiation through the hole is allowed to pass through a magnetic field as shown in the figure. Three separated beams A, B and C could be, respectively.



i) α, β^- and γ ii) β^-, γ and α iii) γ, α and β^-
iv) α, γ and β^- v) γ, β^- and α (2007)

16) When an atom of a radioactive element emits a β^- particle, it is transformed into an atom of a different element. A different element is formed in this manner because,

1) the nucleus of the radioactive element emits a proton.
2) the nucleus of the radioactive element gains a neutron.
3) a proton in the nucleus of the radioactive element changes into a neutron.
4) a neutron in the nucleus of the radioactive element changes into a proton.
5) the radioactive atom emits one of its electrons from an outer orbit (2008)

17) SI unit of "activity" of a radioactive element is,

1) Bq 2) Ci 3) Gy 4) Sv 5) rad (2009)

18) Radioactive element ${}^{232}_{90}Th$ transforms to stable ${}^{208}_{82}Pb$ after several radioactive decays. The number of α particles and the number of β^- particles emitted in these decays respectively are,

1) 6, 2 2) 6, 4 3) 6, 12 4) 4, 4 5) 4, 8 (2009)

19) In the nuclear reaction,

${}^{7}_{3}Li + {}^{A}_{Z}X \rightarrow {}^{A+6}_{Z+2}Y + a$ particle denoted by a is,

1) a proton 2) a electron 3) a neutron 4) an α particle
5) a positron **(2010)**

20) A radioactive isotope of iodine. $^{131}_{53}I$ decays to $^{131}_{54}Xe$. What type of particle is emitted in this decay ?

1) α 2) β^- 3) β^+ 4) p 5) n (2012 N)

21) A slow neutron is absorbed by a $^{235}_{92}U$ nucleus and results in a fission process as follows.

$$^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{139}_{56}Ba + {}^{94}_{36}Kr + x\,{}^{1}_{0}n$$

The value of x (number of neutrons produced) of the above fission process is

1) 1 2) 2 3) 3 4) 4 5) 5 (2013)

22) A radioactive material has a half life of 60 minutes. The percentage of the fraction of material that has decayed during a period of 3 hours is

1) 8.75 % 2) 12.5 % 3) 66.6 %
4) 78.3 % 5) 87.5 % (2014)

23) The following table shows the binding energies of some nuclei.

Nucleus	$^{4}_{2}He$	$^{20}_{10}Ne$	$^{40}_{20}Ca$	$^{60}_{28}Ni$	$^{238}_{92}U$
binding energy (MeV)	28.3	160.6	342.1	526.8	1802.0

Which one of the above nuclei is the most stable nucleus?

1) $^{4}_{2}He$ 2) $^{20}_{10}Ne$ 3) $^{40}_{20}Ca$ 4) $^{60}_{28}Ni$ 5) $^{238}_{92}U$ (2015)

24) The SI unit used to measure the activity of a radioactive source is,

1) Bq 2) Gy 3) J Bq^{-1} 4) Bq^{-1} 5) Sv (2016)

MATTER & RADIATION

01) Radiation

(01)	2	(02)	1	(03)	3	(04)	1	(05)	2	(06)	1	(07)	5
(08)	5	(09)	4, 5	(10)	2	(11)	3	(12)	3				

02) Photoelectric Effect

(01)	1	(02)	4	(03)	1	(04)	1	(05)	4	(06)	3	(07)	4
(08)	2	(09)	3	(10)	1	(11)	5	(12)	3	(13)	4	(14)	2
(15)	4												

03) Particles and Waves

(01)	1	(02)	4	(03)	2	(04)	5	(05)	2

04) Radioactivity

(01)	2	(02)	2	(03)	5	(04)	4	(05)	4, 5	(06)	5	(07)	3
(08)	4	(09)	2	(10)	3	(11)	2	(12)	2	(13)	1	(14)	4
(15)	4	(16)	4	(17)	1	(18)	2	(19)	1	(20)	2	(21)	3
(22)	5	(23)	4	(24)	1								