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Physics DPYQs Test

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Topic : MODERN PHYSICS Time: 90Min Marking: +4 –1

Section - A : All questions are compulsory MCQs

1. The work functions for metals *A*, *B* and *C* are respectively 1.92 eV, 2.0 eV and 5 eV. According to Einstein's equation, the metals which will emit photo electrons for a radiation of wavelength 6400 Å is/are :

(A) None (B) *A* only
(C) *A* and *B* only (D) All the three metals

2. When photons of energy $h\nu$ fall on an aluminium plate (of work function E_0), photoelectrons of maximum kinetic energy *K* are ejected. If the frequency of the radiation is halved, the maximum kinetic energy of the ejected photoelectrons will be :

(A) $K + E_0$ (B) $\frac{1}{2}(K - E_0)$
(C) K (D) $K + h\nu$

3. If the momentum of an electron is changed by *P*, then the de-Broglie wavelength associated with it changes by 0.25 %. The initial momentum of electron will be :

(A) 400 *P* (B) *P*/200
(C) 100 *P* (D) 200 *P*

4. When the energy of the incident radiation is increased by 40%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is :

(A) 0.25 eV (B) 1.0 eV
(C) 1.3 eV (D) 1.5 eV

5. Photons with energy 8 eV are incident on a cathode *C* in a photoelectric cell. The maximum energy of emitted photoelectrons is 2 eV. When photons of energy 7 eV are incident on *C*, no photoelectrons will reach the anode *A*, if the stopping potential of *A* relative to *C* is :

(A) +3 V (B) +4 V
(C) –1 V (D) –3 V

6. The photoelectric threshold wavelength of silver is 6215×10^{-10} m. The velocity of the electron ejected from a silver surface by ultraviolet light of wavelength 3107×10^{-10} m is : (Given $h = 4.14 \times 10^{-15}$ eVs and $c = 3 \times 10^8$ ms^{-1}) :

(A) $\approx 6 \times 10^5$ ms^{-1} (B) $\approx 0.6 \times 10^6$ ms^{-1}
(C) $\approx 61 \times 10^3$ ms^{-1} (D) $\approx 0.8 \times 10^6$ ms^{-1}

7. Light of frequency 1.16 times the threshold frequency is incident on a photosensitive material. What will be the photoelectric current if the frequency is halved and intensity is doubled ?

(A) Zero (B) Doubled
(C) Four times (D) One-fourth

8. Light with an average flux of 40 W/cm^2 falls on a non-reflecting surface at normal incidence having surface area 10 cm^2. The energy received by the surface during time span of 1 minute is :

(A) 48×10^3 J (B) 10×10^3 J
(C) 12×10^3 J (D) 24×10^3 J

9. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 3 mW. The number of photons arriving per second on the average at a target irradiated by this beam is :

(A) 3×10^{19} (B) 9×10^{17}
(C) 3×10^{16} (D) 10×10^{15}

10. A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit. If the speed of the electrons is increased, which of the following statements is correct ?

(A) Diffraction pattern is not observed on the screen in the case of electrons
(B) The angular width of the central maximum of the diffraction pattern will increase
(C) The angular width of the central maximum will decrease
(D) The angular width of the central maximum will be unaffected

11. If the kinetic energy of the particle is increased to 25 times its previous value, the percentage change in the de-Broglie wavelength of the particle is :

(A) 25 (B) 75
(C) 80 (D) 50

12. An electron is accelerated through a potential difference of 40,000 V. Its de-Broglie wavelength is, (nearly) : ($m_e = 9 \times 10^{-31}$ kg) :

(A) 12.2×10^{-13} m (B) 12.2×10^{-12} m
(C) 12.2×10^{-14} m (D) 6.14×10^{-12} m

13. An electron is accelerated from rest through a potential difference of V volt. If the de-Broglie wavelength of the electron is 1.227×10^{-2} nm, the potential difference is :
(A) 10^4 V (B) 10 V
(C) 10^2 V (D) 10^3 V

14. The energy of hydrogen atom in n^{th} orbit is E_n then the energy in n^{th} orbit of singly ionised lithium atom will be :
(A) $4E_n$ (B) $E_n/4$
(C) $9E_n$ (D) $E_n/9$

15. The total energy of electron in the ground state of hydrogen atom is – 13.6 eV. The kinetic energy of an electron in the first excited state is :
(A) 6.8 eV (B) 13.6 eV
(C) 1.7 eV (D) 3.4 eV

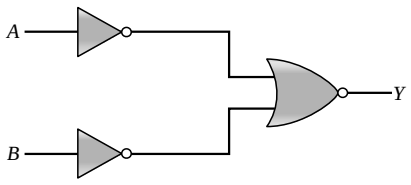
16. The ground state energy of hydrogen atom is –13.6 eV. When its electron is in the second excited state, its excitation energy is :
(A) 10.2 eV (B) Zero
(C) 3.4 eV (D) 12.09 eV

17. The ratio of kinetic energy to the potential energy of an electron in a Bohr orbit of the hydrogen atom, is :
(A) 2 : –1 (B) 1 : –1
(C) 1 : 1 (D) 1 : –2

18. Energy E of a hydrogen atom with principal quantum number n is given by $E = \frac{-13.6}{n^2}$ eV. The energy of a photon ejected when the electron jumps from $n = 4$ state to $n = 1$ state of hydrogen is approximately :
(A) 0.85 eV (B) 3.4 eV
(C) 12.75 eV (D) 1.5 eV

19. Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 13 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be :
(A) Two (B) Three
(C) Four (D) Ten

20. For the logic circuit shown, the truth table is :



(A)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

(B)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(C)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

(D)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

21. Hydrogen atom in ground state is excited by a monochromatic radiation of $\lambda = 975$ Å. Number of spectral lines in the resulting spectrum emitted will be :
(A) 3 (B) 2
(C) 6 (D) 10

22. A sample of radioactive element containing 4×10^{16} active nuclei. Half life of element is 10 days, then number of decayed nuclei after 40 days :
(A) 0.5×10^{16} (B) 3.75×10^{16}
(C) 3.5×10^{16} (D) 1×10^{16}

23. The activity of a radioactive sample is measured as N_0 counts per minute at $t = 0$ and N_0/e counts per minute at $t = 10$ minutes. The time (in minutes) at which the activity reduces to half its value is :
(A) $10 \log_e 2$ (B) $\log_e \frac{2}{5}$
(C) $\frac{10}{\log_e 2}$ (D) $10 \log_{10} 5$

24. The half-life of a radioactive isotope X is 20 years. It decays to another element Y which is stable. The two elements X and Y were found to be in the ratio 1 : 15 in a sample of a given rock. The age of the rock is estimated to be :
(A) 40 years (B) 60 years
(C) 80 years (D) 100 years

25. For a radioactive material, half-life is 20 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is :
(A) 30 (B) 10
(C) 20 (D) 40

26. The mass of proton is 1.0073 u and that of neutron is 1.0087 u (u = atomic mass unit). The binding energy of $_2^4$He is (Given helium nucleus mass $\approx$ 4.0015 u) :
(A) 0.0305 J (B) 0.0305 erg
(C) 28.4 MeV (D) 0.061 u

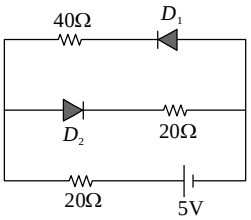
27. The binding energy of deuteron is 2.4 MeV and that of ^4_2He is 28 MeV. If two deuterons are fused to form one ^4_2He then the energy released is :

(A) 25.8 MeV (B) 23.6 MeV
(C) 19.2 MeV (D) 23.2 MeV

28. For a *n*-type semiconductor, which of the following statements is true ?

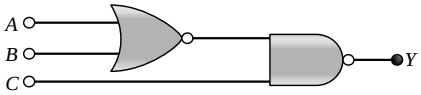
(A) Electrons are the majority carriers and trivalent atoms are the dopants
(B) Holes are the majority carriers and trivalent atoms are the dopants
(C) Holes are the majority carriers and pentavalent atoms are the dopants
(D) Electrons are the majority carriers and pentavalent atoms are the dopants

29. The current in the circuit will be :



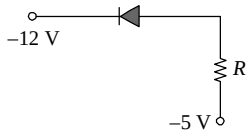
(A) 5/40 A (B) 5/50 A
(C) 5/10 A (D) 5/20 A

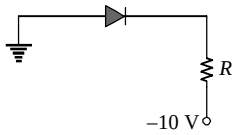
30. To get an output $Y = 0$ in given circuit which of the following input will be correct :

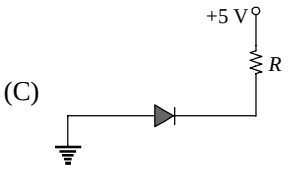


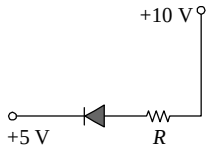
(A) $A \to 1, B \to 0, C \to 1$ (B) $A \to 1, B \to 1, C \to 0$
(C) $A \to 0, B \to 1, C \to 0$ (D) $A \to 1, B \to 0, C \to 0$

31. Of the diodes shown in the following diagrams, which one is reverse biased ?

(A)


(B)


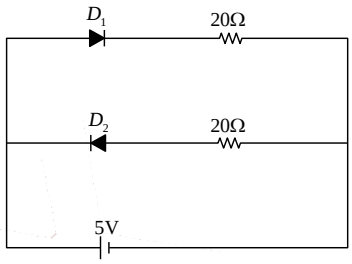
(C)


(D)


32. The peak voltage in the output of a half wave diode rectifier fed with a sinusoidal signal without filter is 20 V. The dc component of the output voltage is :

(A) $10/\sqrt{2}$ V (B) $10/\pi$ V
(C) 10 V (D) $20/\pi$ V

33. Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is :

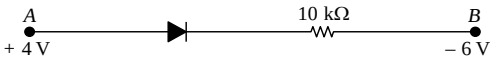


(A) 0.75A (B) Zero
(C) 0.25 A (D) 0.5 A

34. A *npn* transistor is connected in common emitter configuration in a given amplifier. A load resistance of 800 Ω is connected in the collector circuit and the voltage drop across it is 0.8 V. If the current amplification factor is 0.8 and the input resistance of the circuit is 128 Ω, the voltage gain and the power gain of the amplifier will respectively be :

(A) 4, 3.84 (B) 5, 4
(C) 4, 4 (D) 4, 3.69

35. Consider the junction diode as ideal. The value of current flowing through *AB* is :



(A) 0 A (B) 10^{-2} A
(C) 10^{-1} A (D) 10^{-3} A

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Section - B : In actual NEET paper you will be given choice to attempt any 10 out of 15 questions in this section but for this test paper, students are advised to solve all question to compare their preparation with the provided benchmarking

1. A photosensitive metallic surface has work function, $h\nu_0$. If photons of energy 2 $h\nu_0$ fall on this surface, the electrons come out with a maximum velocity of 4×10^6 m/s. When the photon energy is increased to 10 $h\nu_0$, then maximum velocity of photo electrons will be :
(A) 2×10^7 m/s (B) 12×10^6 m/s
(C) 8×10^5 m/s (D) 8×10^6 m/s

2. Light of two different frequencies whose photons have energies 1.0 eV and 3 eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of maximum speeds of emitted electrons will be :
(A) 1 : 4 (B) 1 : 2
(C) 1 : 1 (D) 1 : $\sqrt{5}$

3. A particle of mass 2 mg has the same wavelength as an electron moving with a velocity of 3×10^6 ms^{-1}. The velocity of the particle is : (mass of electron = 9.1×10^{-31} kg) :
(A) 3×10^{-31} ms^{-1} (B) 2.7×10^{-21} ms^{-1}
(C) 1.36×10^{-21} ms^{-1} (D) 9×10^{-2} ms^{-1}

4. Light with an energy flux of 30×10^4 Wm^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is :
(A) 1.25×10^{-6} N (B) 2.50×10^{-6} N
(C) 1.20×10^{-6} N (D) 3.0×10^{-6} N

5. The total energy of an electron in an atom in an orbit is –3.4 eV. Its kinetic and potential energies are, respectively :
(A) –3.4 eV, –3.4 eV (B) –3.4 eV, –6.8 eV
(C) 3.4 eV, –6.8 eV (D) 3.4 eV, 3.4 eV

6. If an electron in a hydrogen atom jumps from the 3rd orbit to the 1st orbit, it emits a photon of wavelength λ. When it jumps from the 4th orbit to the 3rd orbit, the corresponding wavelength of the photon will be :
(A) $\frac{16}{25}\lambda$ (B) $\frac{9}{16}\lambda$
(C) $\frac{20}{7}\lambda$ (D) $\frac{128}{7}\lambda$

7. Half life of a radioactive element is 10 hours and its quantity is 256 g. After how much time its quantity will remain 1g ?
(A) 50 hrs (B) 100 hrs
(C) 150 hrs (D) 80 hrs

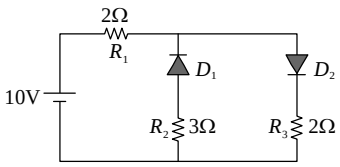
8. Two radioactive substances *A* and *B* have decay constants 10 λ and λ respectively. At $t = 0$ they have the same number of nuclei. The ratio of number of nuclei of *A* to those of *B* will be $(1/e)^2$ after a time interval :
(A) 4 λ (B) 2/9 λ
(C) 1/2 λ (D) 1/4 λ

9. The half life of a radioactive nucleus is 100 days. The time interval $(t_2 - t_1)$ between the time t_2 when two third of it has decayed and the time t_1 when one third of it had decayed is :
(A) 50 days (B) 25 days
(C) 100 days (D) 200 days

10. If the nucleus $^{27}_{13}$Al has nuclear radius of about 3 fm, then $^{125}_{32}$Te would have its radius approximately as :
(A) 9.6 fm (B) 12.0 fm
(C) 5 fm (D) 6.0 fm

11. A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unfragmented nuclei is 6 MeV while that of fragments is 8 MeV. The total gain in the Binding Energy in the process is :
(A) 0.9 MeV (B) 480 MeV
(C) 804 MeV (D) 216 MeV

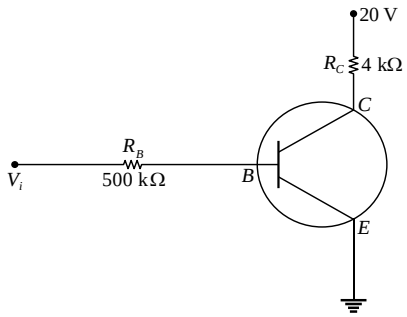
12. The given circuit has two ideal diodes connected as shown in the figure below. The current flowing through the resistance R_1 will be :



(A) 2.5 A (B) 10.0 A
(C) 1.43 A (D) 3.13 A

13. In a common emitter transistor amplifier, the audio signal voltage across the collector resistance of 2 kΩ is 2 V. If the base resistance is 10 kΩ and the current amplification of the transistor is 100, the input signal voltage is :
(A) 0.1 V (B) 1.0 V
(C) 1 mV (D) 10 mV

14. In the circuit shown in the figure, the input voltage V_i is 40 V, $V_{BE} = 0$ and $V_{CE} = 0$. The values of I_B, I_C and β are given by :



(A) $I_B = 20\ \mu A$, $I_C = 5$ mA, β = 250
(B) $I_B = 25\ \mu A$, $I_C = 5$ mA, β = 200
(C) $I_B = 80\ \mu A$, $I_C = 5$ mA, β = 62.5
(D) $I_B = 40\ \mu A$, $I_C = 5$ mA, β = 125

15. A common emitter amplifier has a voltage gain of 20, an input impedance of 100 Ω and an output impedance of 200 Ω. The power gain of the amplifier is :

(A) 1000 (B) 1250
(C) 100 (D) 200

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ANSWER KEY

SECTION-A

1. (B)	**2.** (B)	**3.** (A)	**4.** (B)
5. (C)	**6.** (D)	**7.** (A)	**8.** (D)
9. (D)	**10.** (C)	**11.** (C)	**12.** (D)
13. (A)	**14.** (C)	**15.** (D)	**16.** (D)
17. (D)	**18.** (C)	**19.** (D)	**20.** (B)
21. (C)	**22.** (B)	**23.** (A)	**24.** (C)
25. (D)	**26.** (C)	**27.** (D)	**28.** (D)
29. (A)	**30.** (A)	**31.** (C)	**32.** (D)
33. (C)	**34.** (B)	**35.** (D)	

SECTION-B

1. (B)	**2.** (D)	**3.** (C)	**4.** (D)
5. (C)	**6.** (D)	**7.** (D)	**8.** (B)
9. (C)	**10.** (C)	**11.** (B)	**12.** (A)
13. (A)	**14.** (B)	**15.** (D)	