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QAD Series

Modern Physics

1. **A cathode emits 1.8×10^{14} electrons per second, when heated. When 400V is applied to anode all the emitted electrons reach the anode. The charge on electron is 1.6×10^{-19} C. The maximum anode current is**
   a) 2.7 μA b) 29 μA c) 72 μA d) 29 mA
2. **If the kinetic energy of a free electron doubles, its de-Broglie wavelength changes by the factor**
   a) $\frac{1}{\sqrt{2}}$ b) $\sqrt{2}$ c) $\frac{1}{2}$ d) 2
3. **The work function of a substance is 4.0eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately-**
   a) 540 *nm* b) 400 nm c) 310 nm d) 220 nm
4. **Gases begin to conduct electricity at low pressure because**
   a) At low pressure, gases turn to plasma
   b) Colliding electrons can acquire higher kinetic energy due to increased mean free path leading to ionization of atoms
   c) Atoms break up into electrons and protons
   d) The electrons in atoms can move freely at low pressure
5. **The wavelength of the energy emitted when electron come from fourth orbit to second orbit in hydrogen is 20.397 cm. The wavelength of energy for the same transition in He^+ is-**
   a) 5.099 cm^{-1} b) 20.497 cm^{-1}
   c) 40.994 cm^{-1} d) 81.988 cm^{-1}
6. **In the nuclear fusion reaction $^2_1H+^3_1H\rightarrow^4_2He+n$, given that the repulsive potential energy between the two nuclei is -7.7×10^{-14} J, the temperature at which the gases must be heated to initiate the reaction is nearly [Boltzmann's constant $k = 1.38\times10^{-23}$ J/K]**
   a) 10^9 K b) 10^7 K c) 10^5 K d) 10^3 K
7. **In a working nuclear reactor, Cadmium rods, (control rods) are used to:**
   a) Speed up neutrons b) Slow down neutrons
   c) Absorb some neutrons d) Absorb all neutrons.
8. **For the structural analysis of crystals, X-rays are used because**
   a) X-rays have wavelength of the order of interatomic spacing
   b) X-rays are highly penetrating radiations
   c) Wavelength of X-rays is of the order of nuclear size
   d) X-rays are coherent radiations
9. **In Bohr's model of hydrogen atom, the centripetal force is provided by the Coulomb attraction between the proton and the electron. If a_0 is the radius of the ground state orbit, *m* is the mass and *e* the charge of an electron and e_0 is the vacuum permittivity, the speed of the electron is:**
   a) zero b) $\frac{e}{\sqrt{\varepsilon_0 a_0 m}}$ c) $\frac{e}{\sqrt{4\pi\varepsilon_0 a_0 m}}$ d) $\frac{\sqrt{4\pi\varepsilon_0 a_0 m}}{e}$
10. **The decay constant of a radioactive element is defined as the reciprocal of the time interval after which the number of atoms of radioactive element falls to nearly**
    a) 50 % of its original number
    b) 36.8 % of its original number
    c) 63.2 % of its original number
    d) 75 % of its original number
11. **In the reaction given below $_{86}A^{222}\rightarrow{}_{81}B^{210}$**
    How many α and β – particles are emitted?
    a) 6α, 3β b) 3α, 4β c) 4α, 3β d) 3α, 6β
12. **X-rays when incident on a metal-**
    a) Exert a force on it b) Transfer energy to it
    c) Transfer pressure to it d) All of the above
13. **A nucleus of mass number A, originally at rest, emits an α with speed v. The daughter nucleus recoils with a speed.**
    a) $\frac{2v}{4+A}$ b) $\frac{4v}{A+4}$ c) $\frac{4v}{A-4}$ d) $\frac{2v}{A-4}$
14. **When an electron-pair annihilates the energy released is bout:**
    a) 0.8×10^{-13}J b) 1.6×10^{-13}J c) 3.2×10^{-13}J d) 4.8×10^{-13}J
15. **Radioactive nuclei that are injected into a patient collect at certain sites within its body, undergoing radioactive decay and emitting electromagnetic radiation. These radiations can then be recorded by a detector. This procedure provides an important diagnostic tool called-**
    a) Gamma camera b) CAT scan
    c) Radiotracer technique d) Gamma ray spectroscopy
16. **Threshold wavelength for photoelectric emission from a metal surface is 5200A°.Photoelectrons will be emitted when this surface is illuminated with monochromatic radiation from**
    a) 1 W IR lamp b) 50 W IR lamp
    c) 50 W UV lamp d) 10 W IR lamp
17. **Resistance of semiconductor at 0°K is**
    a) Zero b) Infinite c) Large d) Small
18. **Resistivity of a semiconductor depends on**
    a) Shape of semiconductor
    b) Atomic nature of semiconductor
    c) Length of semiconductor
    d) Shape and atomic nature of semiconductor
19. **When NPN transistor is used as an amplifier**
    a) Electrons move from base to collector
    b) Holes move from emitter to base
    c) Electrons move from collector to base
    d) Holes move from base to emitter
20. **In semiconductors at a room temperature**
    a) The valence band is partially empty and the conduction band is partially filled
    b) The valence band is completely filled and the conduction band is partially filled
    c) The valence band is completely filled
    d) The conduction band is completely empty
21. **Avalanche breakdown is due to:**
    a) Collision of minority charge carrier
    b) Increase in depletion layer thickness
    c) Decrease in depletion layer thickness
    d) None of these
22. **Select the correct statement:**
    a) In a full wave rectifier, two diodes work alternately
    b) In a full wave rectifier, two diodes work simultaneously
    c) The efficiency of full wave and half wave rectifiers is same
    d) The full wave rectifier is bi-directional.
23. **Zener breakdown takes place if:**
    a) Doped impurity is low b) Doped impurity is high
    c) Less impurity in N-part d) Less impurity in P-type
24. **If a full wave rectifier circuit is operating from 50 Hz mains, the fundamental frequency in the ripple will be**
    a) 50 Hz b) 70.7 Hz c) 100 Hz d) 25 Hz

25. The logic behind 'NOR' gate is that it gives
a) High output when both the inputs are low
b) Low output when both the inputs are low
c) High output when both the inputs are high
d) None of these

26. In photoelectric effect, the photo-current:
a) increases with increase of frequency of incident photon b) decreases with increase of frequency of incident photon
c) does not depend on the frequency of photon but depends only on intensity of incident light
d) depends both on intensity and frequency of incident beam

27. The maximum kinetic energy of photoelectron depends on:
a) frequency and intensity of incident light
b) work function and intensity of incident light
c) work function of metal and frequency of incident light
d) frequency and intensity of incident light and also on the work function of metal

28. What is the maximum kinetic energy with which electrons are emitted if the photocurrent stops for 1 volt negative potential?
a) 1 J b) 1.6×10^{-19} J c) $1/1.6 \times 10^{-19}$ J d) 1 erg

29. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per second on an average at a target irradiated by this beam is:
a) 3×10^{16} b) 9×10^{15} c) 3×10^{19} d) 9×10^{17}

30. There are n_1 photons of frequency v_1 in a certain beam of light and n_2 photons of frequency v_2 in another equally intense beam of light. Then
a) $\frac{v_1}{v_2} = \frac{n_1}{n_2}$ b) $\frac{v_1}{v_2} = \frac{n_2}{n_1}$ c) $\frac{v_1}{v_2} = \sqrt{\frac{n_2}{n_1}}$ d) $\frac{v_1}{n_2} = \left(\frac{n_2}{n_1}\right)^2$

31. The electrons behave as waves because
a) they can be diffracted by a crystal
b) they can produce ions in gases
c) they can be deflected by electric & magnetic fields
d) they travel in straight line

32. An electron of mass m, when accelerated through a potential difference V has de-Broglie wavelength λ. The de-Broglie wavelength associated with a proton of mass M accelerated through the same potential difference will be
a) $\lambda\,(m/M)$ b) $\lambda\sqrt{(m/M)}$ c) $\lambda\,(M/m)$ d) $\lambda\sqrt{(M/m)}$

33. A proton and an α-particle are accelerated through the same potential difference. The ratio of their de-Broglie wavelengths (λ_p/λ_α) is:
a) 1 b) 2 c) $\sqrt{8}$ d) $1/\sqrt{2}$

34. A material particle with a rest mass m_0 is moving with speed of light c. The de-Broglie wavelength associated is given by:
a) h/m_0c b) m_0c/h c) 0 d) ∞

35. The ionisation energy of 10 times ionised sodium atom is:
a) 13.6 eV b) 27.2 eV c) $\frac{13.6}{11}$ eV d) $13.6 \times (11)^2$ eV

36. The frequency of the first line of Balmer series in hydrogen atom is v_0. The frequency v of the line emitted by doubly ionised lithium atom (Li^{++}) is:
a) $2v_0$ b) $4v_0$ c) $9v_0$ d) $v_0/9$

37. A strong argument for particle nature of cathode rays is that they:
a) produce fluorescence b) travel through vacuum
c) get deflected by electric and magnetic fields
d) cast shadow

38. Cathode rays moving with same velocity v describe an approximate circular path of radius r metre in an electric field of strength x volt/metre. If the speed of the cathode rays is doubled to 2v, the value of electric field needed so that the rays describe the same approximate circular path (volt/metre) is:
a) 2x b) 3x c) 4x d) 6x

39. In the phenomenon of electric discharge through gases at low pressure, the coloured glow in the tube appears as a result of
a) excitation of electrons in the atoms
b) collision between atoms of gas
c) collision between charged particles emitted from the cathode and the atoms of the gas
d) collision between different electrons of the atoms of the gas

40. A patient is asked to drink $BaSO_4$ solution for examining the stomach by X-rays because X-rays are:
a) less absorbed by heavy atoms
b) more absorbed by heavy atoms
c) diffracted by heavy atoms d) refracted by heavy atoms

41. α, β and γ-rays from a radioactive source are passed through 0.5 mm thick aluminium sheet. The transmitted radiations consist of:
a) α, β and γ rays b) β and γ-rays
c) γ-rays only d) α-rays only

42. A radioactive sample with half life of 1 month is labelled as "Activity = 2 micro curie on 1-8-1991". What would be its activity two months earlier?
a) 1.0 micro curie b) 0.5 micro curie
c) 4 micro curie d) 8 micro curie

43. Half life of two radioactive substances A and B is respectively 20 min and 40 min. Initially the sample of A and B have equal number of nuclei. After 80 minutes, the ratio of remaining number of A and B nuclei is:
a) 1 : 16 b) 4 : 1 c) 1 : 4 d) 1 : 1

44. If 20% of radioactive isotope decays in 5 days, the amount of original material left after 15 days is
a) 20% b) 60% c) 51.2% d) 48.8%

45. The rest energy of an electron is
a) 510 keV b) 931 keV c) 510 MeV d) 931 MeV

46. The minimum energy needed to break carbon $^{12}_{6}C$ into three α-particles: mass of $^{12}_{6}C = 12.0000$ mass of α-particle 4.0038
a) 10.6 MeV b) 1.06 MeV c) 5.3 MeV d) 3.53 MeV

47. In an insulator the forbidden energy gap between a valence band and a conduction band is of the order of
a) 1 eV b) 5 eV c) 1 keV d) 1 MeV

48. When a p-n junction is forward biased:
a) the depletion region is reduced and barrier height is increased
b) the depletion region is widened and barrier height is reduced
c) both the depletion region and barrier height are reduced
d) both the depletion region and barrier height are increased

49. The ratio of forward biased to reverse biased resistance for P-N junction diode is:
a) $10^{-1} : 1$ b) $10^{-2} : 1$ c)10+4 : 1 d) $10^{-4} : 1$

50. For a PNP transistor the value of α in common base configuration is 0.95. Then the current amplification factor in common emitter configuration is
a) 19 b) 49 c) 9.5 d) 190

51. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200Ω. The power gain of the amplifier is
a) 1000 b) 1250 c) 100 d) 5000