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Very Very Important Questions for XIIth Board Exam [Physics]

1. Why does the electric field inside a dielectric decrease when it is placed in an external field. 1 mark

2. For circuits used for transporting electric power, a low power factor implies large power loss in transmission. Example 1 mark

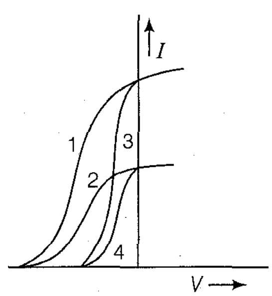
3. Why does a ray of light bend towards normal as it passes from air to glass? 1 mark

4. Two nuclei have mass number in the ratio of 2 : 5. What is the ratio of their nuclear densities? 1 mark

5. A solenoid with an iron core and a bulb a connected to a DC source. How does the brightness of the bulb change, when the iron core is removed from the solenoid? 1 mark

6. The motion of copper plate is damped, when it is allowed to oscillate between the two poles of a magnet. What is the cause of this damping? 1 mark

7. The given graph shows the variation of photoelectric current (I) versus applied voltage (V) for two different photosensitive materials and for two different intensities of the incident radiations. Identify the pairs of curves that correspond to different materials but same intensity of incident radiation. 1 mark



8. Why is the core of a transformer laminated? 1 mark

9. Give reason for the following. 2 marks

   (i) For ground wave transmission, size of antenna (l) should be comparable to wavelength of signal, $l = \lambda / 4$

   (ii) Audio signals converted into an electromagnetic wave, are not directly transmitted as such.

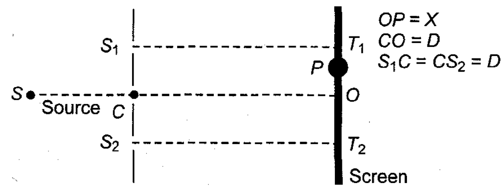
   (iii) The amplitude of modulation signal is kept less than the amplitude of carrier wave.

10. What will happen if emitter is reverse-biased and collector is forward biased in a transistor? 2 marks

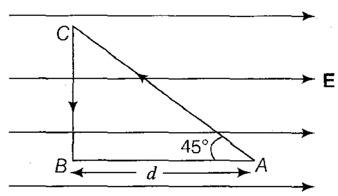
11. Differentiate between interference and diffraction of light. 2 marks

Or

Consider a two slit interference arrangement (figure) such that the distance of the screen from the slits is half the distance between the slits. Obtain the value of D in terms of λ such that the first minima on the screen falls at a distance D from the centre O.

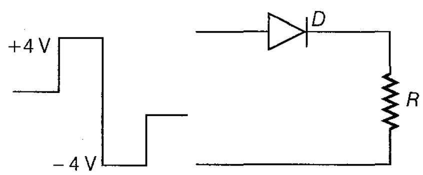


12. A test charge q_0 is moved without acceleration from point A to B along the path A $\rightarrow$ C $\rightarrow$ B as shown in figure. Calculate the potential difference between A and B. 2 marks



13. A transmitting antenna at the top of a tower has a height of 36 m and the height of the receiving antenna is 49 m. What is the maximum distance between them, for satisfactory communication in the LOS made? (Radius of earth = 6400 km) 2 marks

14. What is an ideal diode? Draw the output wavefrom across R for the input wavefrom given below 2 marks



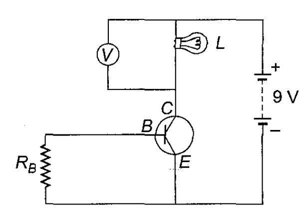
15. A coil of 0.01 H inductance and 1 Ω resistance is connected to 200 V, 50 Hz AC supply. Find the impedance of the circuit and time lag between maximum alternating voltage and current. 2 marks

16. A capacitor made of two parallel plates each of the plate A and separation d, is being charged by an external AC source. Show that the displacement current inside the capacitor is the same as the current charging the capacitor. 2 marks

17. In the given circuit diagram, a voltmeter V is connected across a lamp L. How would 2 marks

(i) the brightness of the lamp and

(ii) voltmeter reading V be affected, if the value of resistance RB is decreased? Justify your answer.



18. Explain with the help of a circuit diagram the working of a photodiode. Write briefly, how it is used to detect the optical signals. 2 marks

19. A message signal of frequency 10 kHz and peak voltage 10 V is used to modulate a carrier of frequency 1 MHz and peak voltage 20 V. 2 marks

Determine

(i) the modulation index

(ii) the side bands produced.

20. An AC generator consist of coil of 100 turns and cross-sectional area of 3 m^2, rotating at a constant angular speed of 60 rad s^{-1} in a uniform magnetic field 0.04 T. The resistance of the coil is 500 Ω. Calculate 2 marks

(i) maximum current drawn from the generator and

(ii) minimum power dissipation of the coil.

21. State three characteristic features which distinguish the interference pattern due to two coherently illuminated sources as compared to that observed in a diffraction pattern due to a single slit. 2 marks

22. Draw typical output characteristics of an n-p-n transistor in CE configuration. Show how these characteristics can be used to determine output resistance? 2 marks

23. A parallel beam of light of 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is at a distance of 2.5 mm from the centre of the screen. Calculate the width of the slit. 2 marks

24. A short bar magnet placed in a horizontal plane has its axis aligned along the magnetic North-South direction. Null points are found on the axis of the magnet at 14 cm from the centre of the magnet. The earth's magnetic field at the place is 0.36 G and the angle of dip is zero. What is the total magnetic field on the normal bisector of the magnet at the same distance as the null-point (i.e., 14 cm) from the centre of the magnet? (At null points, field due to a magnet is equal and opposite to the horizontal component of earth's magnetic field.) 3 marks

25. A man with normal near point (25 cm) reads a book with small print using a magnifying glass of a thin convex lens of focal length 5 cm. 3 marks

(i) What is the closest and the farthest distance at which he should keep the lens from the page, so that he can read the book when viewing through the magnifying glass?

(ii) What is the maximum and the minimum angular magnification (magnifying power) possible using the above simple microscope?

26. In a plot of photoelectric current versus anode potential, how does 3 marks

(i) the saturation current vary with anode potential for incident radiations of different frequencies but same intensity?

(ii) the stopping potential vary for incident radiations of different intensities but same frequency?

(iii) photoelectric current vary for different intensities but same frequency of incident radiations?

Justify your answer in each case.

27. Capacitance of a parallel plate capacitor becomes 4/3 times its original value if a dielectric slab of thickness t = d/2 is inserted between the plates (d is the original separation between the plates) what will be the value of dielectric constant of the slab? 3 marks

28. A resistance of $R\Omega$ draws current from a potentiometer. The potentiometer has a total resistance of $R_0\Omega$. A voltage V is supplied to the potentiometer. Derive an expression for the voltage fed into the circuit when the slide is in the middle of the potentiometer. 3 marks

29. What is space wave propagation? Which two communication methods make use of this mode of propagation? If the sum of the heights of transmitting and receiving antennas in line of sight of communication is fixed at h, show that the range is maximum when the two antenna have a height h/2 each. 3 marks

30. An electromagnetic wave of wavelength λ is incident on a photosensitive surface of negligible work function. If the photo-electrons emitted from this surface have the de-Broglie Wavelength λ_1, Prove that $\lambda = \left(\frac{2mc}{h}\right)\lambda_1^2$. 3 marks

31. A long straight wire of a circular cross-section, of radius a, carries a steady current I. The current is uniformly distributed across the cross-section of the wire. Use Ampere's circuital law to show that the magnetic field, due to this wire, in the region inside the wire, increases in direct proportion to the distance of the field point from the axis of the wire. Write the value of this magnetic field on the surface of the wire. 3 marks

32. For a *CE* transistor amplifier, the audio signal voltage across the collector resistance of $2\,k\Omega$ is 2 V. Suppose the current amplification factor of the transistor is 100. Find the input signal voltage and base current i, if the base resistance is $1\,\Omega$. 3 marks

33. If the nucleons of a nucleus are separated far apart from each other, the sum of masses of all these nucleons is larger than the mass of the nucleus. Where does this mass difference come from? Calculate the energy released if ^{238} nucleus emits an α-particle. 3 marks

Given, atomic mass of $^{238}U = 238.05084$ amu

Atomic mass of $^{234}U = 234.04363$ amu

Atomic mass of α-particle $= 4.00260$ amu

and 1 amu $= 931$ MeV/C^2

34. Draw V-I characteristics of a p-n junction diode. Answer the following questions, giving reasons. 3 marks

(i) Why is the current under reverse bias almost independent of the applied potential upto a critical voltage?

(ii) Why does the reverse current show a sudden increase at the critical voltage?

Name any semiconductor device which operates under the reverse bias in the breakdown region.

35. Name the type of waves which are used for Line of Sight (LOS) communication. What is the range of their frequencies? 3 marks

A transmitting antenna at the top of a tower has a height of 20 m and the height of the receiving antenna is 45 m. Calculate the maximum distance between them for satisfactory communication in Line of Sight mode. (Radius of the Earth = 6.4×10^6 km)

36. (i) What is linearly polaried light? Describe briefly using a diagram, how sunlight is polarised. 3 marks

(ii) Unpolarised light is incident on a polaroid. How would the intensity of transmitted light change when the polaroid is rotated?

37. Write three important factors which justify the need of modulating a message signal. Show diagrammatically, how an amplitude modulated wave is obtained when a modulating signal is superimposed on a carrier wave. 3 marks

38. A capacitor of unknown capacitance is connected across a battery of V volts. The charge stored in it is 360 μC. When potential across the capacitor is reduced by 120 V, the charge stored in it becomes 120 μC. 3 marks

Calculate

(i) the potential V and the unknown capacitance C and

(ii) what will be the charge stored in the capacitor, if the voltage applied is increased by 120 V?

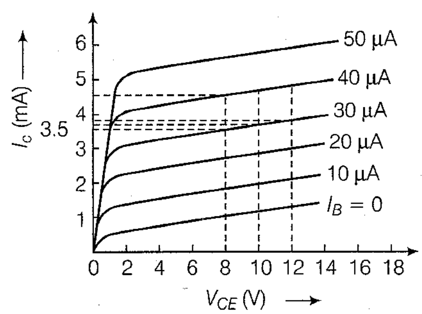
39. (i) In a typical nuclear reaction, e.g. 3 marks

$${}_1^2\mathrm{H} + {}_1^2\mathrm{H} \longrightarrow {}_2^3\mathrm{He} + n + 3.27$$

although number of nucleons is conserved, yet energy is released. How? Explain.

(ii) Show that nuclear density in a given nucleus is independent of mass number A.

40. Output characteristics of an n-p-n transistor in CE configuration is shown in the figure 3 marks



Determine

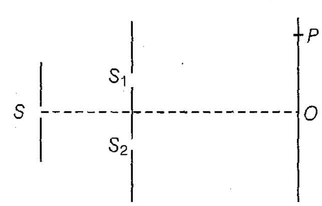
(i) dynamic output resistance (ii) DC current gain

(iii) AC current gain at an operating point $V_{CE} = 10\text{V}$, When $I_B = 30\mu\text{A}$

41. (i) Which property of a Zener diode is used in voltage regulation? Draw a circuit diagram for a voltage regulation and explain its action. 3 marks

(ii) Give some advantages of LED over conventional in candescent lamps3 2 marks

42. In a modified setup of Young's double slit experiment, it is given that $SS_2 - SS_1 = 2\lambda/3$, i.e., the source S is not equidistant from the slits S_1 and S_2. 5 marks

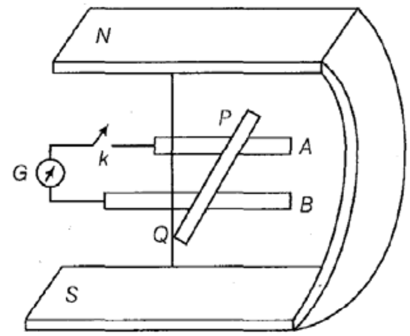


(i) Obtain the conditions for constructive and destructive interference at any point P on the screen in terms of the path difference.

$$\delta = S_2P - S_1P$$

(ii) Does the observed central bright fringe lie above or below O? Give reason to support your answer.

43. Figure below shows a metal rod PQ resting on the matal rails AB and positioned between the poles of a permanent magnet. The rails, the rod, and the magnetic field are in three mutual perpendicular directions. 5 marks



A galvanometer G connects the rails through a switch k. Length of the rod 15 cm, $B = 0.50$ T, resistance of the closed loop containing the rod $= 9.0$ mΩ. Assume the field to be uniform.

(*i*) Suppose k is open and the rod moves with a speed of 12 cm^{-1} in the direction shown. Give the polarity and magnitude of the induced emf.

(*ii*) What is the retarding force on the rod when k is closed?

(*iii*) How much power is required (by an external agent) to keep the rod moving at the same speed ($= 12$ ms^{-1}) when k is closed?

(*iv*) How much power is dissipated as heat in the closed circuit? What is the source of the power?

44. What does the term LOS communication mean? Name the type of waves that are used for this communication. Give typical example with the help of suitable figure of communication systems that use space wave mode propagation. 5 marks

45. (i) Draw the plot of binding energy per nucleon (BE/A) as a function of mass number A. Write two important conclusions that can be drawn regarding the nature of nuclear force. 5 marks

(ii) Use this graph to explain the release of energy in both the processes of nuclear fusion and fission.

(iii) Write the basic nuclear process of neutron undergoing f3-decay. Why is the detection of neutrinos found very difficult?

46. (i) A small compass needle of magnetic moment m is free to turn about an axis perpendicular to the direction of uniform magnetic field B. The moment of inertia of the needle about the axis is I. The needle is slightly disturbed from its stable position and then released. Prove that it executes simple harmonic motion. Hence, deduce the expression for its time period. 5 marks

(ii) A compass needle, free to turn in a vertical plane orients itself with its axis vertical at a certain place on the earth. Find out the values of

(a) horizontal component of earth's magnetic field and

(b) angle of dip at the place.