CBSE – 2007 CLASS XII PHYSICS - II

General Instructions:

1. All questions are compulsory.
2. There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks. You have to attempt only one of the choice in such questions.
3. Question numbers 1 to 5 are very short answer type questions, carrying one mark each.
4. Question numbers 6 to 12 are short answer type questions, carrying two marks each.
5. Question numbers 13 to 24 are also short answer type questions, carrying three marks each.
6. Questions numbers 25 to 27 are long answer type questions, carrying five marks each

. **Q. 1.** In a series LCR circuit, the voltages across an inductor, a capacitor and a resistor are 30 V, 30 V and 60 V respectively. What is the phase difference between the applied voltage and the current in the circuit ? 1

Q. 2. Ultraviolet radiations of different frequencies and are incident on two photosensitive materials having work functions and respectively. The kinetic energy of the emitted electrons is same in both the cases. Which one of the two radiations will be of higher frequency ? 1

Q. 3. Define the term 'activity' of radionuclide. Write its SI unit. 1

Q. 4. An electron is moving a along +ve x-axis in the presence of uniform magnetic field along +ve y-axis. What is the direction of the force acting on it ? 1

Q. 5. What should be the length of dipole antenna for a carrier wave of frequency ? 1

Q. 6. Two point charges and are separated by a distance of 1 m in air. Calculate at what point on the line joining the two charges is the electric potential zero. 2

Q. 7. A voltage of 30 V is applied across a carbon resistor with first, second and third rings of blue, black and yellow colours respectively. Calculate the value of current, in mA, through the resistor. 2

Q. 8. A galvanometer has a resistance of It gives full scale deflection with a current of 2 mA. Calculate the value of the resistance needed to convert it into an ammeter of range 0-0.3 A. 2

Q. 9. Calculate the current drawn by the primary of a transformer which steps down 200 V to 20 V to operate a device of resistance . Assume the efficiency of the transformer to be 80%. 2

Or

An a.c. voltage of 100 V, 50 Hz is connected across a 20 ohm resistor and mH inductor in series. Calculate (i) impedance of the circuit, (ii) rms current in the circuit.

Q. 10. Define resolving power of a compound microscope. How does the resolving power of a
compound microscope change when
(i) refractive index of the medium between the object and objective lens increases ?
(ii) wavelength of the radiation used is increased ? 2

Q. 11. Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is

1. attractive,
2. repulsive. 2

Q. 12. Two semiconductor materials X and Y shown in the given figure, are made by doping germanium crystal with indum and arsenic respectively. The two are joined end to end and connected to a battery as shown.

1. Will the junction be forward biased or reverse biased ?
2. Sketch a V-I graph for this arrangement. 2

Q. 13. State Gauss's theorem in electrostatics. Apply this theorem to derive an expression for electric field intensity at a point near an infinitely long straight charged wire. 3

Q. 14. Explain the underlying principle of working of a parallel plate capacitor.

If two similar plates, each of area A having surface charge densities and are separated by a distance d in air, write expressions for

1. the electric field at points between the two plates.
2. the potnetial difference between the plates.
3. the capacitance of the capacitor so formed. 3

Q. 15. For the potentiometer circuit shown in the given figure, points X and Y reprensent the two terminals of an unknown emf E'. A student observed that when the jockey in moved from the end A to the end B of the potentiometer wire, the deflection in the galvanometer remains in the same direction.

What may be the two possible faults in the circuit that could result in this obsevation ?

If the galvanometer deflection at the end B is (i) more, (ii) less, than that at the end A, which of the two faults, listed above, would be there in the circuit ?

Give reasons in support of your answer in each case. 3

Or

The given figure shows a network of resistances R1, R2, R3 and R4.

Using Kirchhoff's laws, establish the balance condition for the network.

Q. 16. What is Seebeck effect ? Plot a graph showing the variation of thermo emf with temperature of hot junction (keeping cold junction at 0°C) of a thermocouple. How will the (i) neutral temperature, (ii) inversion temperature of a thermocouple change when the temperature of cold junction is increased ? 3

Q. 17. Name the following constituent radiations of electromagnetic spectrum which

1. produce intense heating effect.
2. is absorbed by the ozone layer in the atmosphere.
3. is used for studying crystal structure.

Write one more application forr each of these radiations. 3

Q. 18. A double convex lens of glass of refractive index 1.6 has its both surfaces of equal radii of curvature of 30 cm each. An object of height 5 cm is placed at a distance of 12.5 cm from the lens. Calculate the size of the image formed. 3

Q. 19. Draw a schematic diagram of the experimental arrangement used by Davisson and Germer to establish the wave nature of electrons. Explain briefly how the de-Broglie relation was experimentally verified in case of electrons. 3

Q. 20. Draw the graph to show variation of binding energy per nucleon with mass number of different atomic nuclei. Calculate binding energy/nucleon of nucleus. 3
Given :

mass of
mass of proton = 1.007825 u
mass of neutron = 1.008665 u
and 1 u = 931 MeV/C2

Q. 21. Draw the circuit diagram of a common emitter amplifier using n-p-n transistor. What is the phase differnece between the input signal and output voltage ? State two reasons why a common emitter amplifier is preferred to a common base amplifier. 3

Q. 22. Explain the formation of energy band in solids. Draw energy band diagram for (i) a conductor, (ii) an intrinsic semiconductor. 3

Q. 23. What is modulation ? Explain the need of modulating a low frequency information signal. With the help of diagrams, differentiate between PAM and PDM. 3

Q. 24. Write the acronym LASER in expanded form. State any four reasons for preferring diode lasers as light sources for optical communication links. 3

Q. 25. Explain, with the help of a labelled diagram, the principle and construction of a cyclotron.
Deduce an expression for the cyclotron frequency and show that it does not depend on the speed of the charged particle. 5

Or

Distinguish the magnetic properties of dia, para- and ferro-magnetic substances in terms of (i) susceptibility, (ii) magnetic permeability and (iii) coercivity. Give one example of each of these materials.

Draw the field lines due to an external magnetic field near a (i) diamagnetic,
(ii) paramagnetic substance.

Q. 26. Explain the term 'inductive reactance'. Show graphically the variation of inductive reactance with frequency of the applied alternating voltage.

An a.c. voltage is applied across a pure inductor of inductance L. Show mathematically that the current flowing through it lags behind the applied voltage by aphase angle of . 5

Or

Explain the term 'capacitive reactance'. Show graphically the variation of capacitive reactance with frequency of the applied alternating voltage.

An a.c. voltage is applied across a pure capacitor of capacitance C. Show mathematically that the current flowing through it leads the applied voltage by a phase angle of .

Q. 27. State the essential condition for diffraction of light to take place.

Use Huygen's principle to explain diffraction of light due to a narrow single slit and the formation of a patern of fringes obtained on the screen. Sketch the pattern of fringes formed due to diffraction at a single slit showing variation of intensity with angle . 5

Or

What are coherent sources of light ? Why are coherent sources required to obtain sustained interference pattern ?

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.