LPS

FIRST TERM EXAMINATION 2014 – 2015
CLASS XII – PHYSICS

Time allowed: 3 hours MM 70

General Instructions

All questions are compulsory. Q1 to Q8 – one mark each. Q9 to Q16 – two marks each. Q17 to Q25 – three marks each. Q26 – value based question. Q27 to Q29 – five marks each.

1 A current flowing in a copper wire is passed through another copper wire of same length but double the radius. How will the drift velocity of free electrons change?

2 Two light bulbs are designed for use at 120V and are rated at 75W and 150W. Which light bulb has greater filament resistance?

3 At what temperature would the resistance of a copper conductor be double its value at 0°C. Coefficient of copper is α/°C.

4 Self induction is called the inertia of electrical circuit. Explain.

5 State the working principle of an a. c. generator.

6 The peak value of emf of an a. c. source is E_o. What is its rms value?

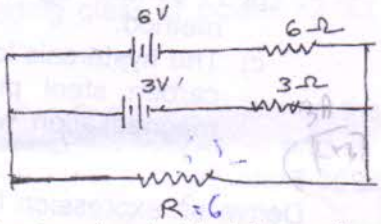
7 Two thin lenses of power +7D and –3D are in contact, find the focal length of the combination.

8 A small telescope has an objective lens 144cm and an eyepiece of focal length 6cm. what is the length of the telescope for normal viewing.

9 Two charged concentric spherical shells have radii 10cm and 15cm. The charge on the inner shell is 4×10^{-8}C and that on the outer shell is 2×10^{-8}C. Find the electric field at r=12cm.

10 Nine copper wires of length 'l' and diameter 'd' are connected in parallel to form a single composite conductor of resistance 'R'. What must be the diameter 'D' of a single copper wire of length 'l' if it is to have the same resistance?

11 For what value of R will no current flow through the 3V battery in the network shown?



12 In a series LCR circuit at resonance, does the current, lead or lag behind the voltage across the generator or it is in phase with the voltage? Write the expression for the power, when the circuit is at resonance.

13 Draw the type of the wave front corresponding to a beam of light from
a) Light emerging out of a convex lens with point source at its focus.
b) Light emerging from a point source
c) The portion of the wave front from a distant star intercepted by earth.

14 How Rutherford's experiment on scattering of α-particles led to the estimation of the size of the nucleus?

15 How is half-life of a radioactive isotope related to average life? The half-life of a radioactive isotope is 140 days. How many days would it take for the decay rate of a sample of this isotope to fall to $\frac{1}{4}^{th}$ of its initial value?

16 Draw a graph showing the variation of binding energy per nuclear with mas number for different nuclei. Explain with the help of this graph the release of energy by the process of nuclear fusion.

OR

Write four characteristic properties of nuclear forces which are different than the coulombian forces.

1080

17 Gauss law is the converse of Coulomb law. Justify this statement. Consider a uniform electric field $E = 3 \times 10^3$ i N/C. What is the net flux of the uniform electric field through a cube of side 20cm, oriented in such a way that its faces are parallel to the coordinate planes?

18 An electrician requires a capacitance of 2μF in a circuit across a potential difference of 2KV. A large number of 1μF capacitors are available to him, each of which can withstand a potential difference of not more than 400V. Suggest a possible arrangement that requires a minimum number of capacitor.

19 What is the effect of the following on the balance condition of a Wheatstone bridge?

a) Current supplied by the cell.
b) Resistance of the galvanometer
c) The position of galvanometer and battery is interchanged

OR

The potential difference across 70cm length of a potentiometer wire balances the potential difference across a 2Ω coil supplied by a cell of emf 2V and internal resistance r ohm. When 1Ω coil is placed in parallel with the 2Ω coil, 50cm of the potentiometer wire is needed to balance the potential difference across the parallel combination. Find r.

20 For a circular coil or radius R and N turns carrying current I, the magnitude of the magnetic field at a point on its axis at a distance x from its centre is given by $B = \frac{\mu_o I R^2 N}{2(x^2 + R^2)^{3/2}}$. Show that this reduces to familiar result for field at centre of the coil.

21 a) Why does a paramagnetic sample displaying greater magnetisation. (for the same magnetic field) when cooled
b) A certain region of space is to be shielded from magnetic field. Suggest a method.
c) The hysteresis loop of a soft iron piece has a much smaller area than that of a carbon steel piece. If the material is to go through repeated cycles of magnetisation, which piece will dissipate greater heat energy?

22 State the condition under which the phenomenon of diffraction of light takes place. Derive an expression for the width of central maximum due to diffraction of light at a single slit.

23 A compound microscope consists of an objective lens of focal length 2.0cm and an eyepiece of focal length 6.25cm separated by a distance of 15cm. How far from the objective should an object be placed in order to obtain the final image at the least distance of distinct vision (25cm).

24 State Bohr's postulate for hydrogen atom. Sketch the energy level diagram for hydrogen atom. Mark the transition corresponding to Lyman and Balmer series.

25 Why do α and β decay produce new elements but γ decay does not?

OR

The total energy of an electron in first excited state of H-atom is about –3.4eV

a) What is the kinetic energy of the electron in this state?
b) Potential energy
c) Which of the answers would change if the choice of zero of potential energy is changed?

26 Once Indu noticed that her aunt was suffering from severe joint pain and could not take any pain killer being allergic to them. In her quest to help her aunt, Indu found the use of magnets. She read Dr Ranjan work on magnetic therapy. She found that many people are negative magnetic field deficient due to electromagnetic pollution. When the

body is supplemented with negative field energy, it brings about quick healing. Indu took her aunt to a magnetic therapy centre on regular basis. Her aunt recovered at a great pace.

a) What are the values being highlighted by Indu?
b) What are the magnitude of the equatorial and axial field due to a bar magnet of length 5cm at a distance of 50cm from the mid point? The magnetic moment of the bar magnet is .40Am^2.

27 a) Obtain the Q factor of a series LCR circuit with L=3.0H C=27μF and R=7.4Ω
b) A small town with a demand of 800kW of electric power at 220V is situated 15km away from an electric plant generating power at 440V. The resistance of the two wire line carrying power is 0.5Ω per km. The town gets power from the line through a 4000–200V step-down transformer at a substation in the town
   i) Estimate the line power loss in the form of heat
   ii) Characterise the step-up transformer at the plant

OR

When an electric device X is connected to a 220V-50Hz a. c. supply, the current is 0.5A and is in same phase as the applied voltage. When another device Y is connected to the same supply, the electric current is again 0.5A but it leads the potential different by $\pi/2$

a) What are the devices X and Y?
b) When X and Y are connected in series across the same source, what will be the current?

28 a) At what angle should a ray of light be incident on the face of a prism of refracting angle 60° so that it just suffers total internal reflection at the other surface? The refractive index of the material of prism is 1.524. [Given: $\sin^{-1}(0.6562)=41°$; $\sin^{-1}(0.4960)=29.8°$]
b) A myopic person has been using spectacles of power –1.0D for distant vision. During old age he also needs to use separate reading glass of power +2.0D. Explain what may have happened.

OR

Trace the rays of light, showing the formation of an image due to a point object on the axis of a spherical surface separating the two media of refractive indices μ_1 and μ_2. Establish a relation between the distances of the object, the image and the radius of curvature from the central point of the spherical surface.

29 Obtain the relation $I = I_o \sin(\omega t + \pi/2)$ and $X_c = \frac{1}{WC}$ for a pure capacitor across which an a. c. emf of $\varepsilon = \varepsilon_o \sin \omega t$ is applied. Draw a phasor diagram. Show that the average power consumed in a purely capacitive circuit in zero.

OR

Draw a diagram to show how a right angled isosceles prism can be used to

a) deviate a ray through 90°
b) deviate a ray through 180°
c) draw a diagram to show the virtual image formation by a spherical mirror and obtain the mirror formula from it.