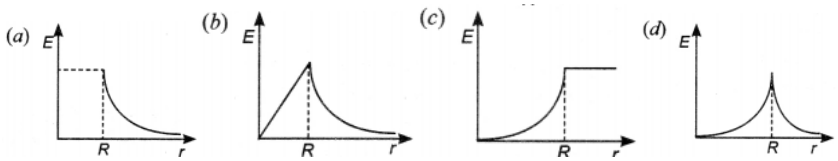
Nitin Sir

F.M : 70	MOCK TEST 1	TIME: 3 HOURS

SECTION-A (ONE MARK EACH)

1. On charging by conduction, mass of a body may
   (a) increase (b) decreases (c) increase or decrease (d) None of these
2. A photon beam of energy 12.1eV is incident on a hydrogen atom. The orbit to which the electron of the H atom be excited is :
   a. 2^{nd} B. 3^{rd} C. 4^{th} D. 5^{th}
3. Which of the following can be added as an impurity to obtain n-type semiconductor?
   a. Arsenic B. Phosphorus C. Aluminium D. Bismuth
4. Two charges of equal magnitudes kept at a distance r exert a force F on each other. If the charges are halved and distance between them is doubled, then the new force acting on each charge is
   $(a)\ \frac{F}{8}$ $(b)\ \frac{F}{4}$ $(c)\ 4F$ $(d)\ \frac{F}{16}$
5. If potential difference V applied across a conductor is doubled how will the drift velocity be affected?
   a. Halved B. Doubled C. Four times D. Remain same
6. Which of the following graphs shows the variation of electric field E due to a hollow spherical conductor of radius R as a function of distance from the centre of the sphere?



7. In YDSE, the distance between the slits is halved, what will be the change in the fringe width?
   A. Halved B. Doubled C. No change D. Four times
8. For light diverging from a point source, (more than one correct)
   (a) the wavefront is spherical (b) the intensity decreases in proportion to the distance squared
   (c) the wavefront is parabolic (d) the intensity at the wavefront does not depend on the distance
9. On rubbing, when one body gets positively charged and other negatively charged, the electrons transferred from positively charged body to negatively charged body are
   (a) valence electrons only (b) electrons of inner shells
   (c) both valence electrons and electrons of inner shell (d) yet to be established
10. An object approaches a convergent lens from the left of the lens with a uniform speed 5 m/s and stops at the focus. The image
    (a) moves away from the lens with an uniform speed 5 m/s.
    (b) moves away from the lens with an uniform acceleration.
    (c) moves away from the lens with a non-uniform acceleration.
    (d) moves towards the lens with a non-uniform acceleration
11. Complete the following nuclear reaction:
    $5B^{10} + 2He^{4} \rightarrow 7N^{13} +$ _____
12. A free floating magnetic needle at North pole is _____ to the surface of the earth.
13. An equilateral prism is made up of material of refractive index $\sqrt{3}$. The angle minimum deviation of light passing through the prism is _____
14. An electron is accelerated through a potential difference of 100V, then De Broglie wavelength associated with it is approximately _____ A^{o}

    Use the following codes to answer the next four questions:
    a. If both assertion and Reason are true and R is the correct explanation of A
    b. If both A and R are true but R is not the correct explanation of A
    c. If A is true but R is false
    d. If A is false but R is true
15. A. A convex mirror can not form real images
    R. A convex mirror converges the rays after reflection

Address: Vivekanand Apartment, Ground Floor, D-3 Diamond park, Joka, Kolkata - 700104
Phone: +91-8617247400 ; **Email**: lumosmaths@gmail.com; **Facebook**: @mathemagic.nitin

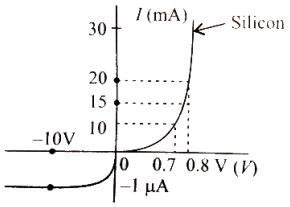
16. **A:** There is no electric field in the conductor
    R: There are plenty of free electrons in the conductors which moves in such a way, it cancel every electric field in the conductor
17. **A:** Coulombs Force is an action reaction pair
    R: Coulombs force is non conservative in nature
18. A. In half wave rectification the result is not obtained at certain time intervals
    R. The Diode is not operational in reverse bias condition

SECTION-B (TWO MARKS EACH)

19. Given a uniform electric field E = 5 x 10^3 $\hat{\imath}$ N/C, find the flux of this field through a square of 10 cm on a side whose plane is parallel to the y-z plane. What would be the flux through the same square if the plane makes a 30° angle with the x-axis?
20. What are optical fibres? Give their one use.
21. The V-I characteristics of a silicon diode is given in the figure. Calculate the resistance of the diode at a) I_D = 15mA and b) V_D = -10V

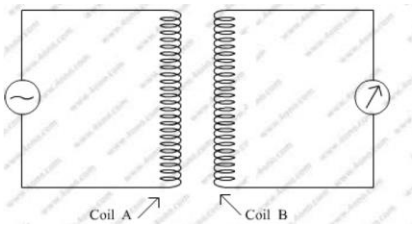
    OR

    The work function of caesium is 2.14 eV. Find (a) the threshold frequency for caesium, and (b) the wavelength of the incident light if the photocurrent is brought to zero by a stopping potential of 0.60 V.



22. Using the Rydberg formula, calculate the wavelengths of the first four spectral lines in the Lyman series of the hydrogen spectrum.
23. Prove that an ideal capacitor, in an a.c. circuit does dissipate power.
24. The circuit arrangement given below shows that when an a. C. passes through the coil the current flowing in the coil B.
    State the underlying principle involved.
    Mention two factors on which the current produced in the coil B depends.

25. Draw the equipotential surfaces due to an electric dipole. Locate the points where the potential due to the dipole is zero.
    OR
    The ratio of the intensities at minima to the maxima in Young's double-slit experiment is 9:25. Then find the ratio of the widths of the two slits.



SECTION – C (THREE MARKS EACH)

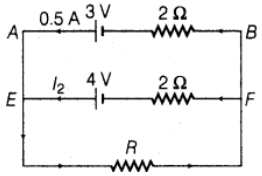
26. Draw the operational circuit for the operation of a full wave rectifier. Sketch the input and output waveform obtained by it.
27. What is meant by angle of deviation of a prism? What is the condition for minimum deviation by a prism. Obtain the angle of deviation for a prism in terms of angle of incidence, angle of emergence and angle of the prism

    OR

    Derive the mirror formula for a concave mirror forming a real and inverted image. Take usual notations and sign convention.
28. Without using gauss's law obtain the formula for electric field due to a long thin wire of uniform linear charge density 'λ'.

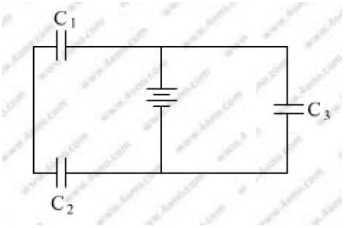
OR

Determine the following from the given diagram
(i)the voltage drop across the unknown resistor R and
(ii)the current I_2 in the arm EF



29. State faraday's law of electromagnetic induction.
A jet plane is travelling towards west at a speed of 1800 km/h. What is the voltagedifference developed between the ends of the wing having a span of 25 m, if the earth's
magnetic field at the location has a magnitude of 5 × 10−4T and the angle is 300?

30. Three identical capacitors C1, C2 and C3 of capacitance 6μF each are connected to a 12 V battery as shown.
(i) charge on each capacitor
(ii) equivalent capacitance of the network
(iii) energy stored in the network of capacitors



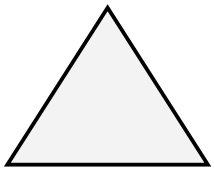
SECTION – D (FIVE MARKS EACH)

31. (a) Draw a labelled ray diagram to show the formation of image in an astronomical telescope for a distant object.
write three distinct advantage of a reflecting type telescope over a refracting type telescope.
(b) A convex lens of focal length 10 cm is placed coaxially 5 cm away from a concave lens of focal length 10 cm. If an object is placed 30 cm in front of the convex lens, find the position of the final image formed by the combined system.

32. (a) Write the expression for the force, $\vec{F}$ acting on a charged particle of charge 'q'moving with a velocity $\vec{v}$ in the presence of both electric field E⃗ and magnetic field B⃗. Obtain the condition under which the particle moves undeflected through the fields.
(b) A rectangular loop of size l × b carrying a steady current I is placed in a uniform magnetic field B⃗. Prove that the torque τ⃗ acting on the loop is given by τ⃗ = m⃗ × B⃗, where m is the magnetic moment of the loop.

OR

(a) Derive ab expression for the torque experienced by an electric dipole kept in a uniform electric field.
(b) Calculate the work done to dissociate the system of three charged placed on the vertices of a triangle as shown. ⃗ = ⃗. ⃗ × ⃗⃗-⃗⃗ . Each side is 10cm



33. A device X is connected across an ac source of voltage V = V_0 sin ωt. The current through X is given as I = I_0 sin (ωt +π/2).
(a) Identify the device X and write the expression for its reactance.
(b) Draw graphs showing variation of voltage and current with time over one cycle of ac, for X.
(c) How does the reactance of the device X vary with frequency of the ac? Show this variation graphically.
(d) Draw the phasor diagram for the device X.

SECTION – E (FOUR MARKS EACH)

34. CASE STUDY 1

Speed of Electromagnetic Wave

Maxwell showed that the speed of an electromagnetic wave depends on the permeability and permittivity of the medium through which it travels. The speed of an electromagnetic wave in free space is given by $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$.

The fact led Maxwell to predict that light is an electromagnetic wave. The emergence of the speed of light from purely electromagnetic considerations is the crowning achievement of Maxwell's electromagnetic theory. The speed of an electromagnetic wave in any medium of permeability μ and permittivity ε will be $\frac{c}{\sqrt{K\mu_r}}$ where K is the dielectric constant of the medium and μ_r is the relative permeability.

(i) The dimensions of $\frac{1}{2}\varepsilon_0 E^2$ (ε_0 : permittivity of free space; E = electric field) is

(a) MLT^{-1} (b) ML^2T^{-2} (c) $ML^{-1}T^{-2}$ (d) ML^2T^{-1}

(ii) Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of the vacuum. If M = mass, L = length, T = time and A = electric current, then

(a) $[\varepsilon_0] = M^{-1}L^{-3}T^2A$ (b) $[\varepsilon_0] = M^{-1}L^{-3}T^4A^2$

(c) $[\varepsilon_0] = MLT^{-2}A^{-2}$ (d) $[\varepsilon_0] = ML^2T^{-1}$

(iii) An electromagnetic wave of frequency 3 MHz passes from vacuum into a dielectric medium with permittivity $\varepsilon = 4$. Then

(a) wavelength and frequency both remain unchanged

(b) wavelength is doubled and the frequency remains unchanged

(c) wavelength is doubled and the frequency becomes half

(d) wavelength is halved and the frequency remains unchanged.

(iv) Which of the following are not electromagnetic waves?

(a) cosmic rays (b) γ-rays (c) β-rays (d) X-rays

35. CASE STUDY 2:

Discovery of Nucleus

The nucleus was first discovered in 1911 by Lord Rutherford and his associates by experiments on scattering of α-particles by atoms. He found that the scattering results could be explained, if atoms consist of a small, central, massive and positive core surrounded by orbiting electrons. The experimental results indicated that the size of the nucleus is of the order of 10^{-14} m and is thus 10000 times smaller than the size of atom.

(i) Ratio of mass of nucleus with mass of atom is approximately

(a) 1 (b) 10 (c) 10^3 (d) 10^{10}

(ii) Masses of nuclei of hydrogen, deuterium and tritium are in ratio

(a) 1 : 2 : 3 (b) 1 : 1 : 1 (c) 1 : 1 : 2 (d) 1 : 2 : 4

(iii) Nuclides with same neutron number but different atomic number are

(a) isobars (b) isotopes (c) isotones (d) none of these

(iv) If R is the radius and A is the mass number, then log R versus log A graph will be

(a) a straight line (b) a parabola (c) an ellipse (d) none of these.