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ROLLNO

CLASS XII
PHYSICS (Theory)

VCBE/PO2/B/12

Time allowed: 3 hours

Maximum Marks: 70

General Instructions:

(i) All questions are compulsory..

(iii) Q.No. 1 to 8 are very short answer type questions, carrying one mark each.

(iv) Q.No numbers 9 to 18 are short answer type questions, carrying two marks each.

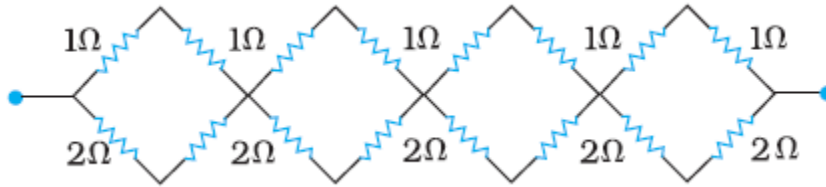
(v) Q.No. 19 to 27 are also short answer type questions, carrying three marks each.

(vi) Q.No. 28 to 30 are long answer type questions, carrying five marks each.

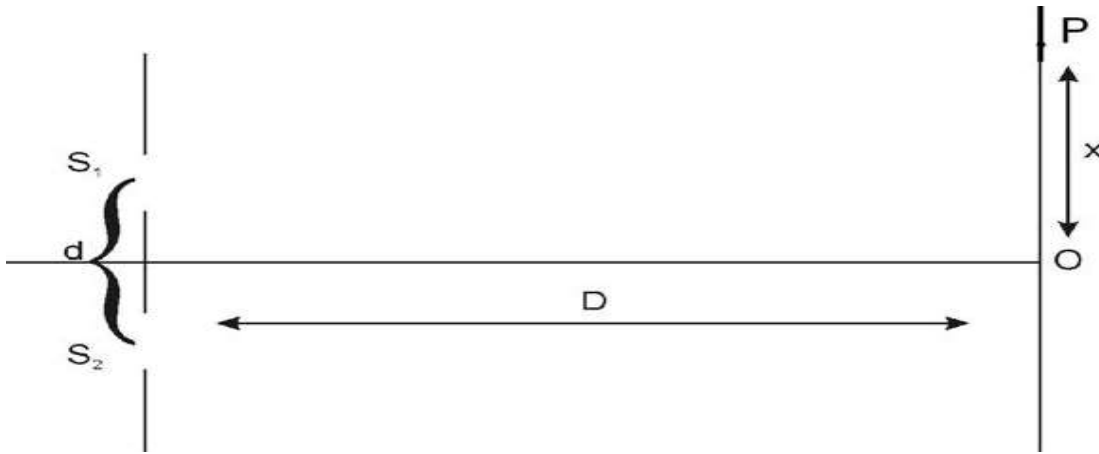
(viii) You may use the following values of physical constants wherever necessary

$c=3 \times 10^8$ m/s $h=6.6 \times 10^{-34}$ Js $e=1.6 \times 10^{-19}$ C $N_A = 6.023 \times 10^{23}$ /mole $m_n = 1.67 \times 10^{-27}$ kg $\mu_0 = 4\pi \times 10^{-7}$ T-m/A
 $m_e = 9 \times 10^{-31}$ kg

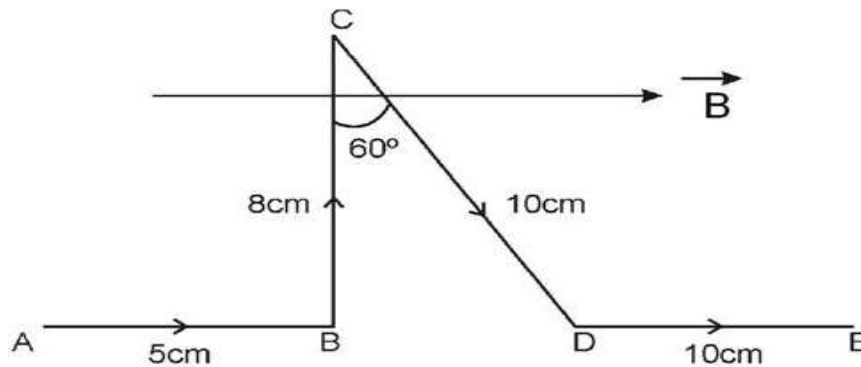
- Why can one ignore quantisation of electric charge when dealing with macroscopic i.e., large scale charges?
- Find the net resistance between two ends.



- Show, on a graph, the nature of variation, of the associated de –Broglie wavelength with the accelerating potential, for an electron initially at rest.
- What is ideal ammeter? Write one characteristic.
- A ray of light, incident on an equilateral glass prism of refractive index 1/1.73 moves parallel to the base of the prism, inside it. What is the angle of incidence for this ray?
- A proton, and an alpha particle, both initially at rest, are (suitably) accelerated so as to have the same kinetic energy .What is the ratio of their de-Broglie wavelength?
- Define displacement current. Write its expression.
- The mean life of a radioactive sample is T. What is the time in which 25% of this sample would get delayed?
- A point charge of $2.0\mu\text{C}$ is at the centre of a cubic Gaussian surface 9.0 cm on edge. What is the net electric flux through the surface?
- An electric heater is connected, turn by turn, to a D.C and A.C sources of equal voltages. Will the rate of heat production be same in the two cases? Explain
- The intensity, at the central maxima(O) in a Young’s double slit set up is I_0 .If the distance OP equals one third of the fringe width of the pattern, show that the intensity, at point P., would equal $I_0/4$



12. Why radio waves are communication waves .Write two uses of the waves.
13. Find the magnitude of the force on each segment of the wire shown below, if a magnetic field of 0.30 T, is applied parallel to AB and DE. Take the value of the current, flowing in the wire, as 1 ampere.



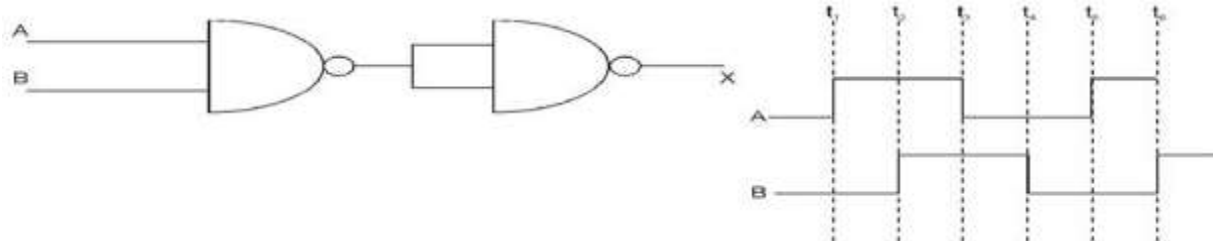
14. Light of wave length 2000 \AA , falls on a metal surface of work function 4.2 eV . What is the kinetic energy (in eV) of (a) the fastest and (b) the slowest photo electrons emits from the surface?
15. The work function of caesium is 2.14 eV . Find (a) the threshold frequency for caesium, and (b) the wavelength of the incident light if the photocurrent is brought to zero by a stopping potential of 0.60 V .
16. Name the physical quantity whose SI unit is curie (Ci): how is this quantity related to (a) disintegration constant (b) half life, and(c) mean life of the radioactive element?

OR

Write the equation for α -decay .What happens to neutron proton ratio in a α -decay.

17. Draw V-I graph for a Zener diode. Why it act as a voltage regulator

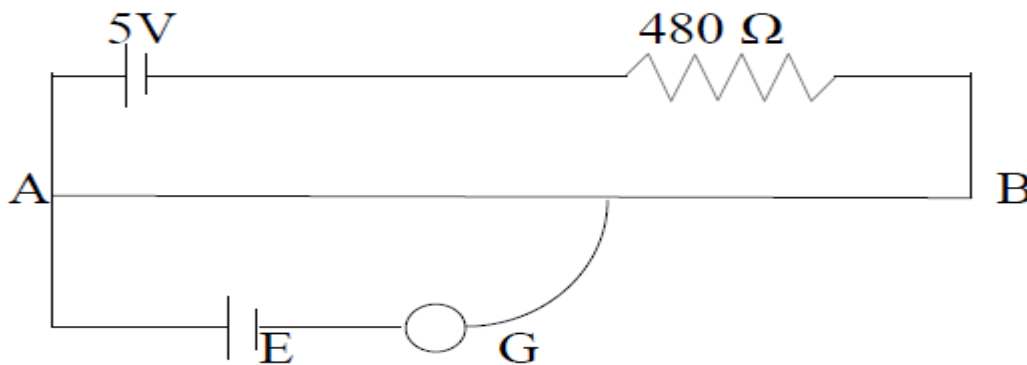
18. Draw the output wave from at X, using the given inputs A, B for the logic circuit shown below. Also identify the equivalent gate



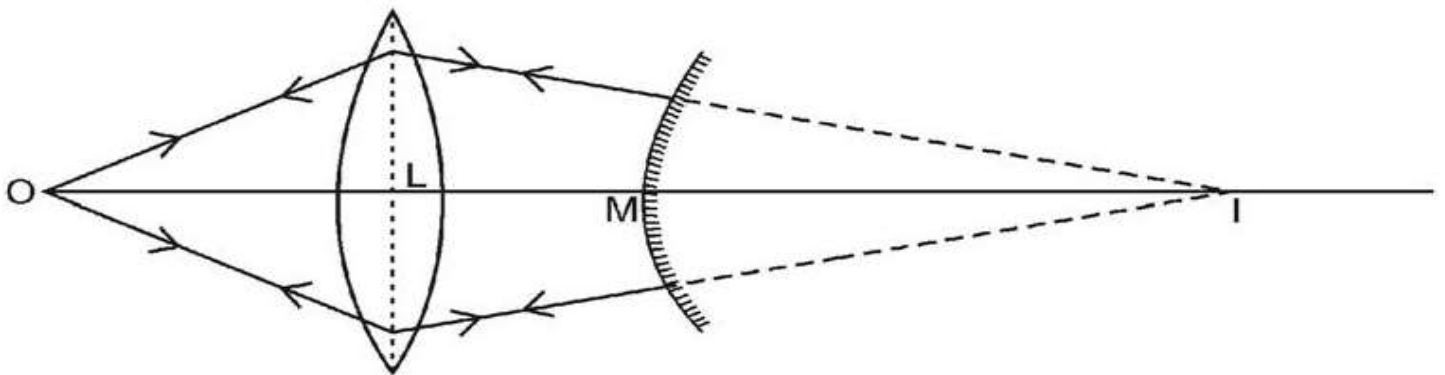
19. Draw a circuit diagram of transistor as a device. Write its two applications.

20. A resistor of resistance 400Ω , and a capacitor of reactance 200Ω , are connected in series to a $220V, 50Hz$. a.c source. If the current in the circuit is $0.49A$ find the (a) voltage across the resistor and capacitor (b) value of inductance required so that voltage and current are in phase.

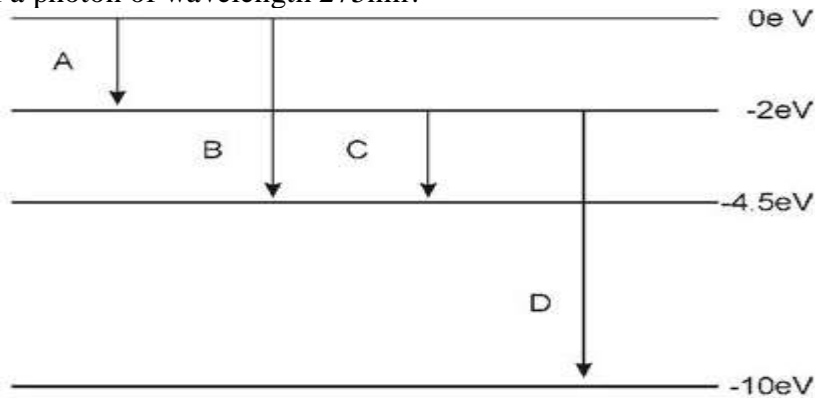
21. A $10m$ long wire of uniform cross section and 20Ω resistance is used in a potentiometer. The wire is connected in series with a battery of $5V$ along with an external resistance of 480Ω . If a cell of an unknown emf E is balanced at $6.0m$ length of wire, calculate (a) the potential gradient of potentiometer wire and (b) the unknown emf E



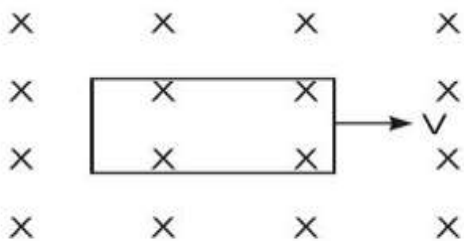
22. An object is places at a distance of $30cm$ from a convex lens of radius of curvature of $40cm$.On the other side of the lens, a convex mirror is placed such that its distance, from the lens, equals the focal length of the lens. The image formed by this combination is observed to coincide with the object itself. Find the focal length of the convex mirror.



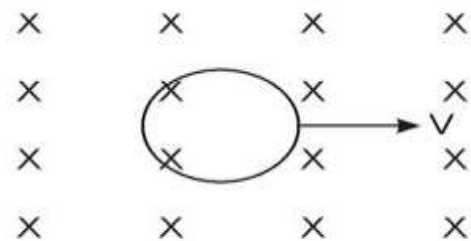
23. The energy levels of a hypothetical atom are as shown below. Which of the shown transitions will result in the emission of a photon of wavelength 275nm?



24. A rectangular loop and a circular loop are moving out of a magnetic field to a field free region with a constant velocity. It is given that the field is normal to the plane of both the loops.



(a)



(b)

Draw the expected shape of the graphs, showing the variation of the flux, with time, in both the cases. What is the cause of the difference in the shapes of the two graphs?

25. Two convex lenses, of equal length, but of aperture A_1 and A_2 ($A_2 < A_1$), are used as the objective lenses in two astronomical telescopes having identical eyepieces. Compare the ratio of their (a) resolving power

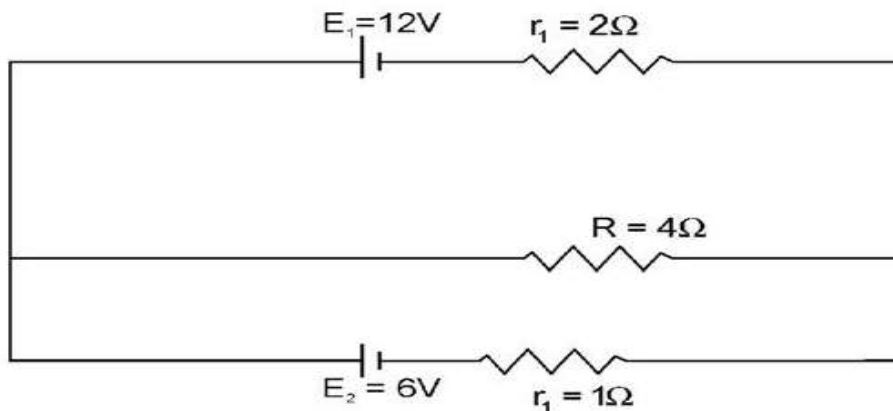
(b)(normal) magnifying power and (c) intensity of images formed by them. Which one of the two telescopes should be preferred? Why?

VECTOR CLASSES

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26. Find the potential difference across each cell and the current in resistance R.



27. Give reasons for the following:-

- (a) For ground wave transmission, size of antenna (l) should be comparable to wavelength of signal $l = \lambda/4$
 - (b) Why transducer is needed in communication
 - (c) Write function of Amplifier
28. How a full wave rectifier works. Draw its Diagram. Write the function of filter circuits

OR

What is an oscillator circuit? How a transistor as an oscillator works.

29. State the essential condition for the diffraction of light to take place. A parallel beam of monochromatic light falls normally on a narrow slit and light coming out of the slit is obtained on the screen. Derive the expression for the conditions of secondary maxima and minima.

When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why?

OR

What is fringe width? Derive the expression a beam of light consisting of two wavelengths, 650 nm and 520 nm, is used to obtain interference fringes in a Young's double-slit experiment. (a) Find the distance of the

fourth dark fringe on the screen from the central maximum for wavelength 650 nm. (b) What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide? Given $d=2\text{mm}$ and $D=120\text{cm}$.

30. A magnetic dipole is placed in a uniform magnetic field with its axis tilted with respect to its position of a stable equilibrium. Deduce an expression (a) for the time period of oscillation of this magnetic dipole about an axis, passing through its centre and perpendicular to its plane. (b) torque acting on the dipole (c) Magnetic potential energy of the dipole.

OR

Derive the expression for the torque acting on a rectangular loop placed in a uniform magnetic field. A circular coil of 20 turns and radius 10 cm is placed in a uniform magnetic field of 0.10 T normal to the plane of the coil. If the current in the coil is 5.0 A, what is the (a) total torque on the coil, (b) total force on the coil, (c) average force on each electron in the coil due to the magnetic field?

(The coil is made of copper wire of cross-sectional area 10^{-5} m^2 , and the free electron density in copper is given to be about 10^{29} m^{-3} .)

31. Find the expression for the electric field intensity, and the electric potential, due to a dipole at a point on the axial line. Would the electric field be necessarily zero at a point where the electric potential is zero? Give an example to illustrate your answer.

Draw E- r graph and V-r graph for a negative charged spherical shell.

OR

Find the expression for the capacitance of a parallel plate capacitor of area A and plate separation d (a) a dielectric slab of thickness t, and (b) a metallic slab of thickness t, where $t < d$ are introduced one by one between the plates of the capacitor. In which case would the capacitance be more and why?

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