BHARTIYA SHIKSHA BOARD
SAMPLE QUESTION PAPER 2025-26
CLASS - XII
PHYSICS (150)

Maximum Marks: 70 **Time Allowed: 3 hours**

General Instructions

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

(3) All the sections are compulsory.

(4) **Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.**

(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

(6) Use of calculators is not allowed.

(7) You may use the following values of physical constants where ever necessary

i. $c = 3 \times 10^8$ m/s

ii. $m_e = 9.1 \times 10^{-31}$ kg

iii. $m_p = 1.7 \times 10^{-27}$ kg

iv. $e = 1.6 \times 10^{-19}$ C

v. $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

vi. $h = 6.63 \times 10^{-34}$ J s

vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$

viii. Avogadro's number = 6.023×10^{23} per gram mole

Section A

1.	If a positive charge is shifted from a low-potential region to a high-potential region, the electric potential energy (a) increases (b) decreases (c) remains the same (d) may increase or decrease	(1)
2.	An electric dipole is placed in a uniform electric field. The net electric force on the dipole (a) is always zero (b) depends on the orientation of the dipole (c) can never be zero (d) depends on the strength of the dipole	(1)
3.	Two resistors R and 2R are connected in series in an electric circuit. The thermal energy developed in R and 2R are in the ratio (a) 1:2 (b) 2:1 (c) 1:4 (d) 4:1	(1)
4.	A circular loop of area $1cm^2$, carrying a current of 1A, is placed in a magnetic field of 0.1T perpendicular to the plane of the loop. The torque on the loop due to the	(1)

magnetic field is

(a) zero (b) 10^{-4} N m (c) 10^{-2} N m (d) 1 N m

5. A free electron is placed in the path of a plane electromagnetic wave. The electron will start moving (1)

(a) along the electric field (b) along the magnetic field (c) along the direction of propagation of the wave (d) in a plane containing the magnetic field and the direction of propagation

6. A series AC circuit has a resistance of 4 Ω and a reactance of 3 Ω. The impedance of the circuit is (1)

(a) 5 Ω (b) 7 Ω (c) 12/7 Ω (d) 7/12 Ω

7. Which of the following relation is correct? (1)

(a) $\sqrt{\varepsilon_0 E_0} = \sqrt{\mu_0 B_0}$ (b) $\sqrt{\mu_0 \varepsilon_0} = \frac{B_0}{E_0}$

(c) $E_0 = \sqrt{\mu_0 \varepsilon_0 B_0}$ (d) $\sqrt{\mu_0 E_0} = \sqrt{\varepsilon_0 B_0}$

8. An electromagnetic wave of frequency $\nu = 30$ MHz passes from vacuum into a relative dielectric medium with permittivity $\varepsilon_r = 4$ and relative permeability $\mu_r = 1$. (1)

(a) wavelength is doubled and the frequency ~~$\nu = 2.0$ MHz~~ remains unchanged.

(b) wavelength is halved and frequency becomes half.

(c) wavelength is halved and frequency remains unchanged

(d) wavelength and frequency both remain unchanged.

9 A plano convex lens is made of a material of refractive index 1.6. The radius of curvature of the curved surface is 60 cm The focal length of the lens is (1)

(a) 60 cm (b) 100 cm (c) 200 cm (d) 400 cm.

10 If h and E denote the linear momentum and energy of a photon. If the wavelength is decreased (1)

(a) both h and E increase

(b) h increases and E decreases

(c) h decreases and E increases

(d) both h and E decrease

11. In which of the following transition of the photon will the wavelength ~~of the photon emitted~~ be minimum? (1)

(a) $n=5$ to $n=4$ (b) $n=4$ to $n=3$ (c) $n=3$ to $n=2$

(d) $n=2$ to $n=1$

12. Ratio of the radii of the nuclei with mass number 8 and 27 would be (1)

(a) $\frac{27}{8}$ (b) $\frac{8}{27}$ (c) $\frac{2}{3}$ (d) $\frac{3}{2}$

For Q.13 to Q.16, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below

(a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

13.	Assertion (A) — The binding energy per nucleon, for nuclei with atomic mass number $A > 100$ decrease with A. Reason (R) — The forces are weak for heavier nuclei.	(1)
14	Assertion (A) — Microwaves are better carriers of signal than optical waves Reason (R) — Microwaves move faster than optical waves	(1)
15.	Assertion (A) — When a light wave travels from a vacuum to a denser medium, it loses speed. The reduction in speed implies a reduction in energy carried by light wave. Reason (R) — The energy of a wave is proportional to speed of wave.	(1)
16.	Assertion (A) — Susceptibility of diamagnetic substances depends on temperature. Reason (R) — Diamagnetic substances can be magnetised by increasing temperature.	(1)

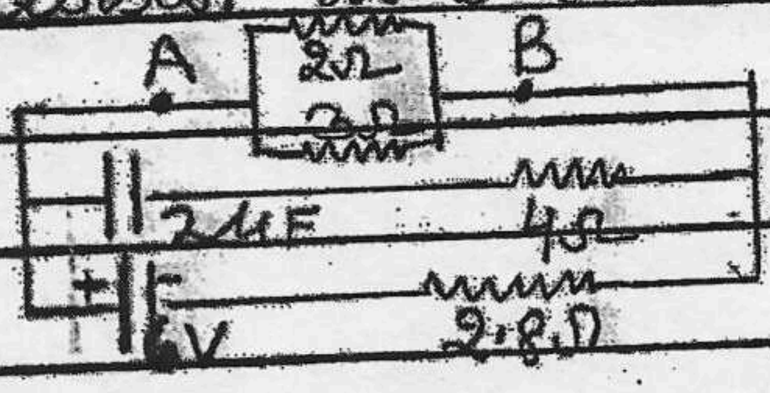
Q. No.

Section - B.

17. Two metallic wires of the same material have the same length but cross-sectional area in the ratio 1:2. They are in connected (i) in series (ii) in parallel. Compare the drift velocities of electrons in the two wires in both the cases (2)

OR

Calculate the steady current through the 2Ω resistor in the circuit shown. (2)



18. The plane of a circular coil is horizontal (2)
it has 10 turns, each of radius 8 cm. A current of 2A flows through it, which appears clockwise from a point vertically above it. Find the magnitude and direction of the magnetic field at the centre of the coil due to the current.

Q.	What is the effect on the interference	(2)
	fringes in a young's double slit experi	
	ment if (i) the separation between the	
	two slits is increased;	
	(ii) the monochromatic source is replaced	
	by a source of white light?	
20.	Find the ratio of de Broglie wave-	(2)
	length associated with a proton and	
	an alpha particle when both are	
	(i) accelerated from rest through the	
	same potential difference, and	
	(ii) moving with the same kinetic	
	energy.	
21.	The energy of the electron in the ground	(2)
	state of hydrogen atom is -13.6 eV.	
	(i) What does the negative sign signify?	
	(ii) How much energy is required to take	
	an electron in this atom from the	
	ground state to the first excited state?	
	Section- C	
22.	A conducting slab of thickness 't' is intro-	(3)
	duced within and touching between the	

plates of a parallel plate capacitor, separated by a distance d ($t \leq d$). Derive an expression for the capacitance of the capacitor.

23. Following are two statements about the relationship between the electric field and electric potential. Giving examples, predict whether these two statements are correct or false. (3)

(i) If the electric field at a certain point is zero, then the electric potential at the same point is also zero.

(ii) If the electric potential is constant in a region, then the electric field is zero in that region

24. Derive a mathematical expression for the force per unit length acting on each of the two straight parallel metallic conductors carrying currents I_1 and I_2 in the same direction respectively and kept at a distance d apart in free space. Why do such conductors attract each other? (3)

(i) Two identical protons separated by a distance r are travelling in the same direction with a velocity v. Calculate the magnitude and direction of the (i) magnetic force (ii) electric force experienced by each proton.

(ii) Calculate the magnetic field produced by a revolving electron at the centre of the orbit if v is the orbiting speed of electron and r is the radius of orbit.

25. (i) A ray of light falls on a triangular glass prism in such a way that the deviation of the emergent ray is minimum for the prism. Draw the ray diagram for this case and write the relation between the angle of incident and angle of emergence. (2+1)

(ii) A ray of light falls on a transparent right-angled isosceles prism made from a glass of refractive index $\sqrt{2}$. Draw the ray diagram for this prism when the incident ray

falls normally on one of the equal sides of this prism.

26. A beam of light of two wavelengths (2+1)
650 nm and 520 nm is used to obtain
interference fringes in Young's double slit
experiment. The distance between the plane
of the slits and the screen is 1.20 m
and the distance between the slits is 0.20 mm
(a) Find the distance of the third bright
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?

27. State the important processes that 3
occur during the formation of a p-n
junction.
Explain briefly, with the help of a suitable
diagram, how a p-n junction is formed.
Define the term 'barrier potential'.

Q. No.	Question	
28	(a) Distinguish between an intrinsic semiconductor and a p-type semiconductor. Give reason why a p-type semiconductor is electrically neutral, although $n_h >> n_e$.	(3)
	(b) Explain, how the heavy doping of both p-side and n-side of a p-n junction diode results in the electric field of the junction being extremely thin even with a reverse bias voltage of a few volts.	(3)

Section-D

Case Study based questions

Question numbers 29 and 30 are case study based questions. Read the following paragraphs and answer the questions that follow.

29. A charge q moving with a velocity $\vec{v}$ in presence of both electric and magnetic fields experiences a force $\vec{F} = q[\vec{E} + \vec{v} \times \vec{B}]$. If electric and magnetic fields are perpendicular to each other and

also perpendicular to the velocity of the particle, the electric and magnetic forces are in opposite directions. If we adjust the value of electric and magnetic field such that magnitude of the two forces are equal. The total force on the charge is zero and the charge will move in the fields undeflected.

(i) What will be the value of velocity (1)
of the charge particles when it moves undeflected in a region where electric field is perpendicular to the magnetic field and the charge particle enters at right angles to the fields

(a) $v = \frac{E}{B}$ (b) $v = \frac{B}{E}$ (c) $v = E.B$ (d) $v = \frac{E.B}{q}$

(ii) Proton, neutron, alpha particle and (1)
electron enters a region of uniform magnetic field with same velocities. The magnetic field is perpendicular to the velocity which particle will experience maximum force?

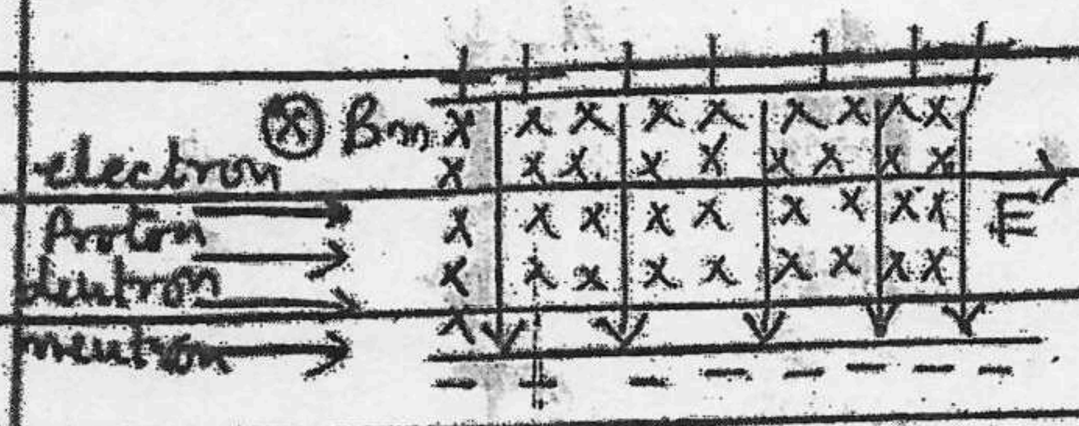
(a) proton (b) electron (c) alpha particle

Q. No.	Question	Marks
	(d) neutron	
(iii)	A charge particle moving with a constant velocity passing through a space without any change in the velocity. Which can be true about this region? (a) $E=0, B=0$ (b) $E\neq0, B\neq0$ (c) $E=0, B\neq0$ (d) All of these.	(1)
(iv)	Proton, electron and deuteron enter a region of uniform magnetic field with same electric potential difference at right angles to the field. Which one has a more curved trajectory? (a) electron (b) proton (c) deuteron (d) all will have same radius of circular path OR	(1)
(iv)	If proton, electron and deuteron enter a region of uniform magnetic field with same velocity at right angle to the fields and proton passes the region without any deflection which statement is correct about other particles a. All particle will go without any deflection b. electron and deuteron will be deflected	(1)

in opposite direction

(c) electron and deutron will be deflected towards electric field

(d) electron and deutron will be deflected towards magnetic field.



30. Photo electric effect is the phenomenon of emissions of electrons from a metal surface when radiation of suitable frequency fall on them. The emitted electrons are called photoelectrons and the current so produced is called photoelectric current.

(i) With the increase of intensity of incident radiations, photoelectrons emitted by a photo tube, the number of photoelectrons emitted per unit time (a) increases (b) decreases (c) remains same (d) cannot be predicted (1)

(ii) It is observed that photoelectron emission (1)
stops at a certain time t after light
source is switched on and potential of plate
is changed. The stopping potential (V) can be
represented as

(a) $2\left(\frac{KE_{max}}{e}\right)$ (b) $\left(\frac{KE_{max}}{e}\right)$ (c) $\left(\frac{KE_{max}}{2e}\right)$

(d) $\left(\frac{KE_{max}}{2e}\right)$

(iii) A point source of light of power (1)
2.2×10^{-3} W emits monoenergetic photons
of energy 5.0 eV and work function
2.0 eV. The efficiency of photoelectron
emission is 1 for every 10^6 incident photons.
Assume that photoelectrons are instant-
aneously swept away after emission.
The maximum kinetic energy of photon
is

(a) 4 eV (b) 3 eV (c) 2 eV (d) Zero

(iv) Which of the following device is the (1)
application of Photoelectric effect?

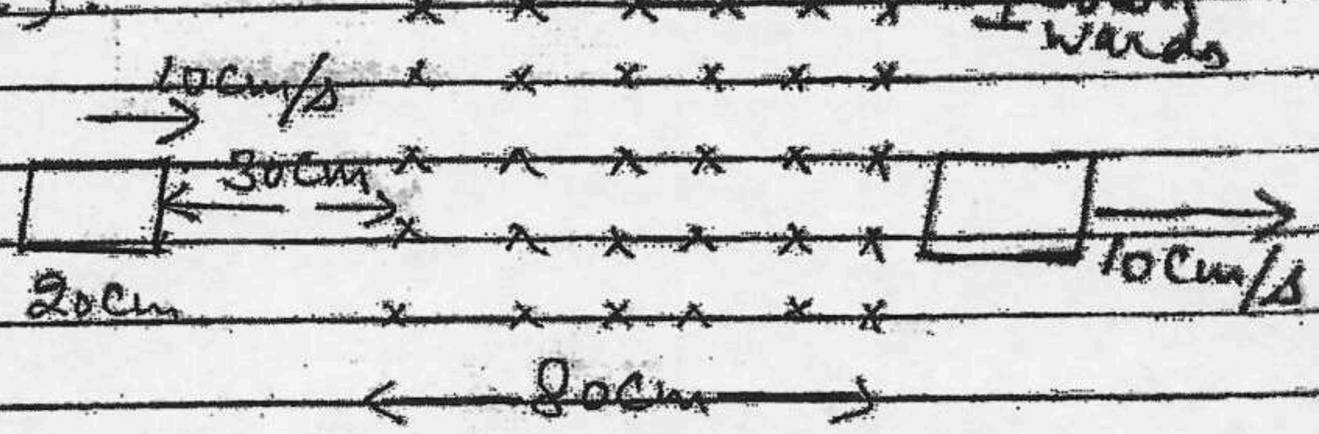
(a) Light emitting diode (b) Diode
(c) Photocell (d) Transistor

OR

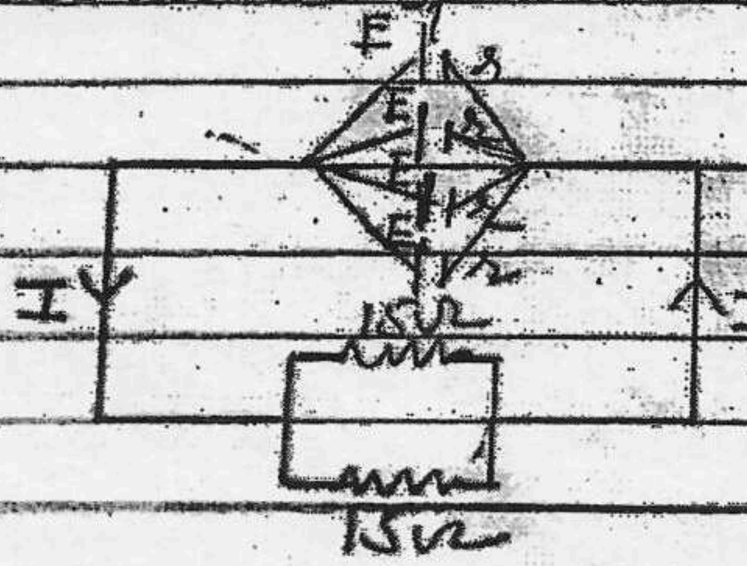
Q.No.	Question	Mar
	iv) If the frequency of incident light falling on a photosensitive metal is doubled, the kinetic energy of the emitted photoelectron is (a) unchanged (b) halved (c) doubled (d) more than twice its initial value	(1)
	Section - F	
31	(a) Draw graphs showing the variations of inductive reactance and capacitive reactance with frequency of applied ac. source.	(5)
	(b) Draw the phasor diagram for a series LCR circuit connected to an ac. source.	
	(c) When an ac. voltage of 220V is applied across a device X, a current of 0.25A flows which lags behind the applied voltage in phase by $\frac{\pi}{2}$ radians. If the same voltage ~~in phase~~ is applied across another device Y, the same current flows but now it is in phase with the applied voltage. (i) Name the devices X and Y. (ii) Calculate the current flowing in the circuit when the same voltage is applied across the series combination of X and Y.	
	Or	
	(a) Define mutual inductance of a pair of coils and write on which factors does it depend.	5 = 2+3
	(b) A square loop of side 20cm is initially kept 30cm away from a region of uniform magnetic field of 0.1T as shown in the figure. It is then moved towards the right with a velocity of 10cm/s till it goes out of the field.	

Q-No. Question

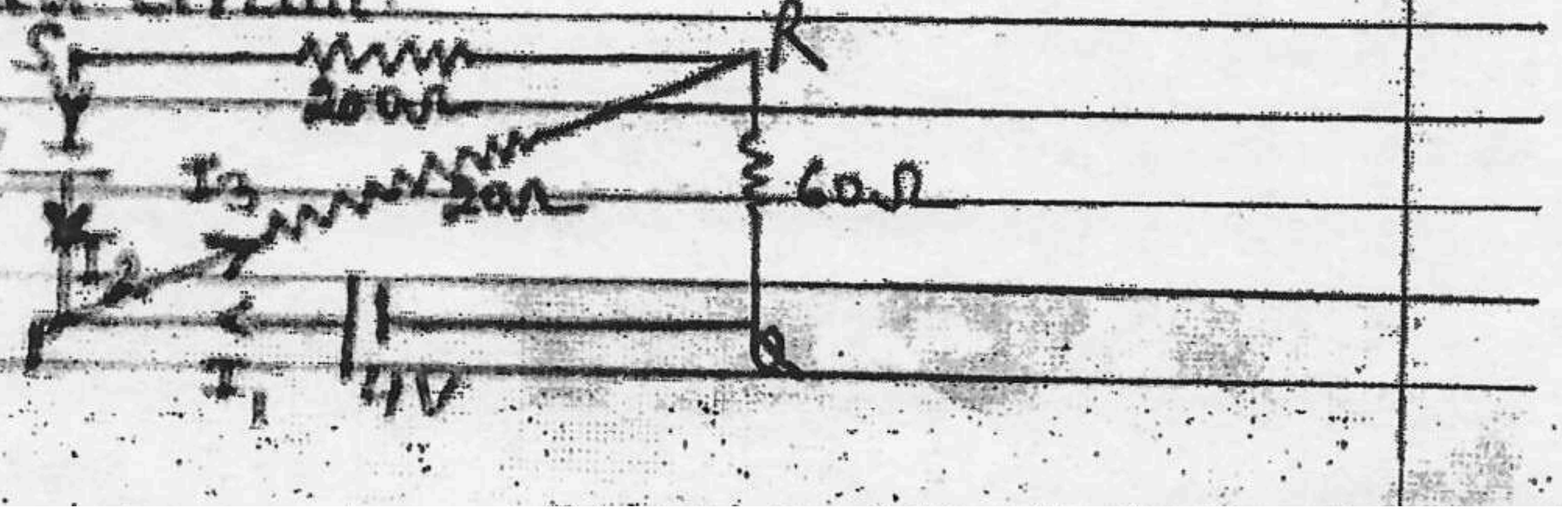
Plot a graph showing the variation of
(i) magnetic flux (ϕ) through the loop with time (t)
(ii) induced current in the loop, if it has resistance of 0.1Ω
(ii) induced emf (e) in the loop with time (t).



32. (a) Four identical cells each of emf 2V are joined in parallel providing supply of current to external circuit consisting of two 15Ω resistors joined in parallel. The terminal voltage of the cells as read by an ideal voltmeter is 1.6V. Calculate the internal resistance of each cell. 5 (2+3)

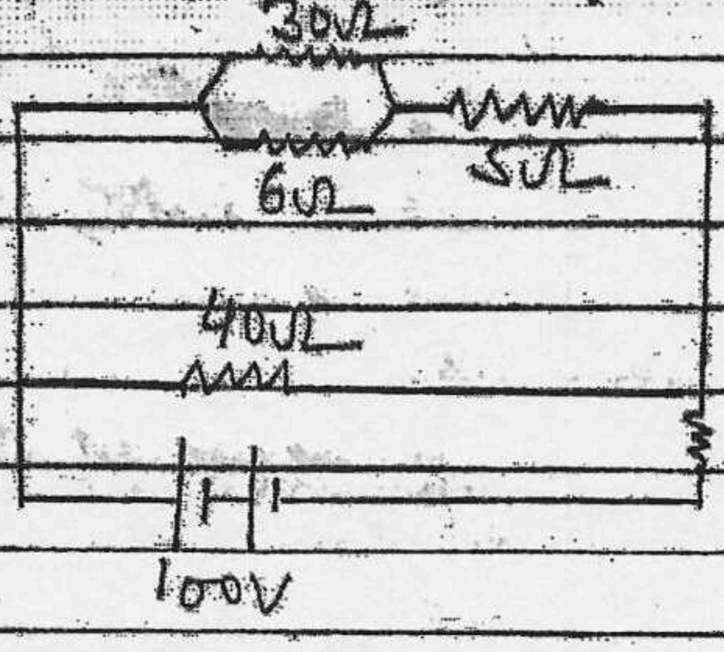


(b) State kirchhoff's rules. Apply these rules to the loops PRSP and PRQP to write the expressions for the currents I_1, I_2 and I_3 in the given circuit.

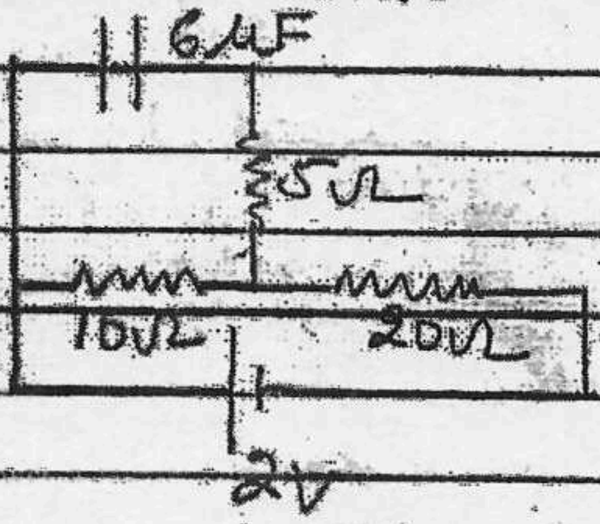


OR

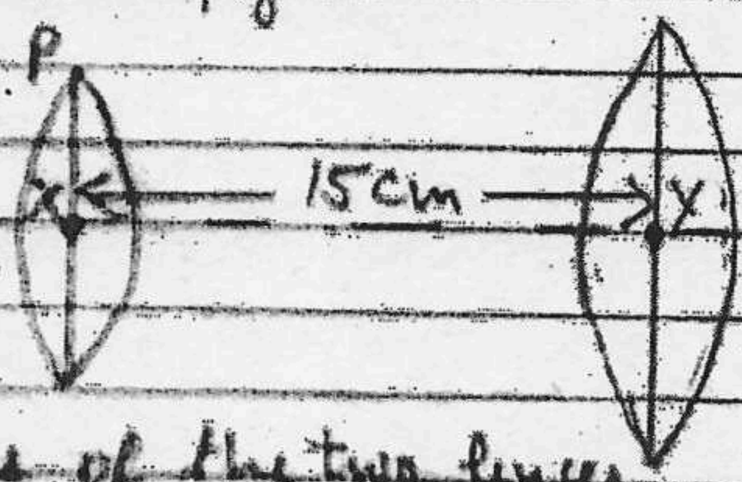
(a) A 100V battery is connected to the electric network as shown. If the power consumed in the 2Ω resistor is 200W, determine the power dissipated in the 5Ω resistor. 5 = (3 + 2)



(b) Find the charge on the capacitor in the given circuit.



33 (a) Two convex lenses P and Q of an astronomical telescope having focal lengths 4cm and 16 cm respectively are arranged as shown in the figure. 5 = (3 + 2)



(i) Which one of the two lenses will you select to use as the objective lens and why?

(ii) What should be the change in the

Question	Marks
distance between the lenses to have the telescope in its normal adjustment position (iii) Calculate the magnifying power of the telescope in the normal adjustment position.	
(b) Explain the basic difference between the construction and working of a telescope and a microscope	
Or	
(a) Define the term 'wavefront of light'. A plane wavefront AB propagating from denser medium (1) into rarer medium (2) is incident on the surface P_1P_2 separating the two media as shown in figure. Using Huygen's principle, draw the secondary wavelets and obtain the refracted wavefront in the diagram.	5 = (2+3)
(b) What are coherent sources of light? Two coherent light waves of intensity $5 \times 10^{-2} Wm^{-2}$ each superimpose and produce the interference pattern on a screen. At a point where the path difference between the waves is $\frac{\lambda}{6}$, λ being wavelength of the wave, find the (i) phase difference between the waves (ii) resultant intensity at the point. (iii) resultant intensity in terms of the intensity at the maximum