

Reg. No. :

Code No. 2015

Name :

**Second Year – JUNE 2016
SAY / IMPROVEMENT**

Time : 2 Hours
Cool-off time : 15 Minutes

Part – III

PHYSICS

Maximum : 60 Scores

General Instructions to Candidates :

- There is a 'cool-off time' of 15 minutes in addition to the writing time of 2 hrs.
- You are not allowed to write your answers nor to discuss anything with others during the 'cool-off time'.
- Use the 'cool-off time' to get familiar with questions and to plan your answers.
- Read questions carefully before answering.
- All questions are compulsory and only internal choice is allowed.
- When you select a question, all the sub-questions must be answered from the same question itself.
- Calculations, figures and graphs should be shown in the answer sheet itself.
- Malayalam version of the questions is also provided.
- Give equations wherever necessary.
- Electronic devices except non-programmable calculators are not allowed in the Examination Hall.

നിർദ്ദേശങ്ങൾ :

- നിർദ്ദിഷ്ട സമയത്തിന് പുറമെ 15 മിനിറ്റ് 'കൂൾ ഓഫ് ടൈം' ഉണ്ടായിരിക്കും. ഈ സമയത്ത് ചോദ്യങ്ങൾക്ക് ഉത്തരം എഴുതാനോ, മറ്റുള്ളവരുമായി ആശയവിനിമയം നടത്താനോ പാടില്ല.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം എഴുതണം.
- ഒരു ചോദ്യനമ്പർ ഉത്തരമെഴുതാൻ തെരഞ്ഞെടുത്തു കഴിഞ്ഞാൽ ഉപചോദ്യങ്ങളും അതേ ചോദ്യനമ്പറിൽ നിന്ന് തന്നെ തെരഞ്ഞെടുക്കേണ്ടതാണ്.
- കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നൽകിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

1. Match the following :

A	B	C
Radio waves	Nuclear reactions	Destroy cancer cells
Ultraviolet rays	Inner shell electron transition	Detect fake currency notes
	Acceleration of charges in conducting wires	Physical therapy
		Cellular phones

(Scores : 2)

2. The atomic hydrogen emits lines spectrum consisting of various series.

(a) Name the series observed first.

(Score : 1)

(b) Draw the energy level diagram of hydrogen atom.

(Scores : 2)

3. Vector form of a law can be written as $\vec{J} = \sigma \vec{E}$.

The above equation is an equivalent form of a famous law. Name the law.

(i) Biot-Savart's law

(ii) Ohm's law

(iii) Coulomb's law

(iv) Gauss's law

(Score : 1)

4. Gauss's theorem is useful in determining the electric field when the source distribution has symmetry.

(a) The electric field intensity at a distance 'r' from a uniformly charged infinite plane sheet of charge is

(i) Proportional to r

(ii) Proportional to $\frac{1}{r}$

(iii) Proportional to r^2

(iv) Independent of r

(Score : 1)

(b) A thin spherical shell of radius 'R' is uniformly charged to a surface charge density σ . Using Gauss's theorem derive the expression for the electric field produced outside the shell.

(Scores : 2)

5. Draw the labelled block diagram of an amplitude modulator for obtaining AM wave.

(Scores : 2)

The following is a choice question.

6. (A) The force exists between the nucleons in a nucleus is called nuclear force.

(a) The nuclear force between two protons, two neutrons and between a proton and a neutron is denoted by f_{pp} , f_{nn} and f_{pn} respectively, then

(i) $f_{pp} = f_{nn} \neq f_{pn}$

(ii) $f_{pp} \neq f_{nn} = f_{pn}$

(iii) $f_{pp} = f_{nn} = f_{pn}$

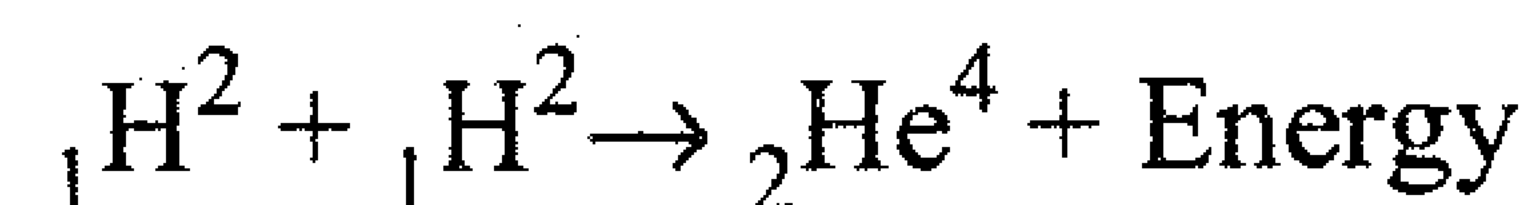
(iv) $f_{pp} \neq f_{nn} \neq f_{pn}$

(Score : 1)

(b) What is the meaning of mass defect ?

(Score : 1)

(c) Calculate the energy released in the nuclear reaction shown below :



mass of $({}_1\text{H}^2) = 2.014102 \text{ u}$

mass of $({}_2\text{He}^4) = 4.0026 \text{ u}$

1 a.m.u = 931 MeV

(Scores : 2)

OR

(B) (a) What is meant by half-life of a radionucleus ?

(Score : 1)

(b) The half-life of Polonium is 140 days. How long will it take to reduce to 1 g. Polonium out of its initial mass of 16 g ?

(Scores : 2)

(c) Which one of the following particles can be used for the disintegration of a radioactive nucleus ?

(i) Proton

(ii) Neutron

(iii) Electron

(iv) Deuteron

(Score : 1)

7. (a) You are given two capacitors having capacitances C_1 and C_2 .

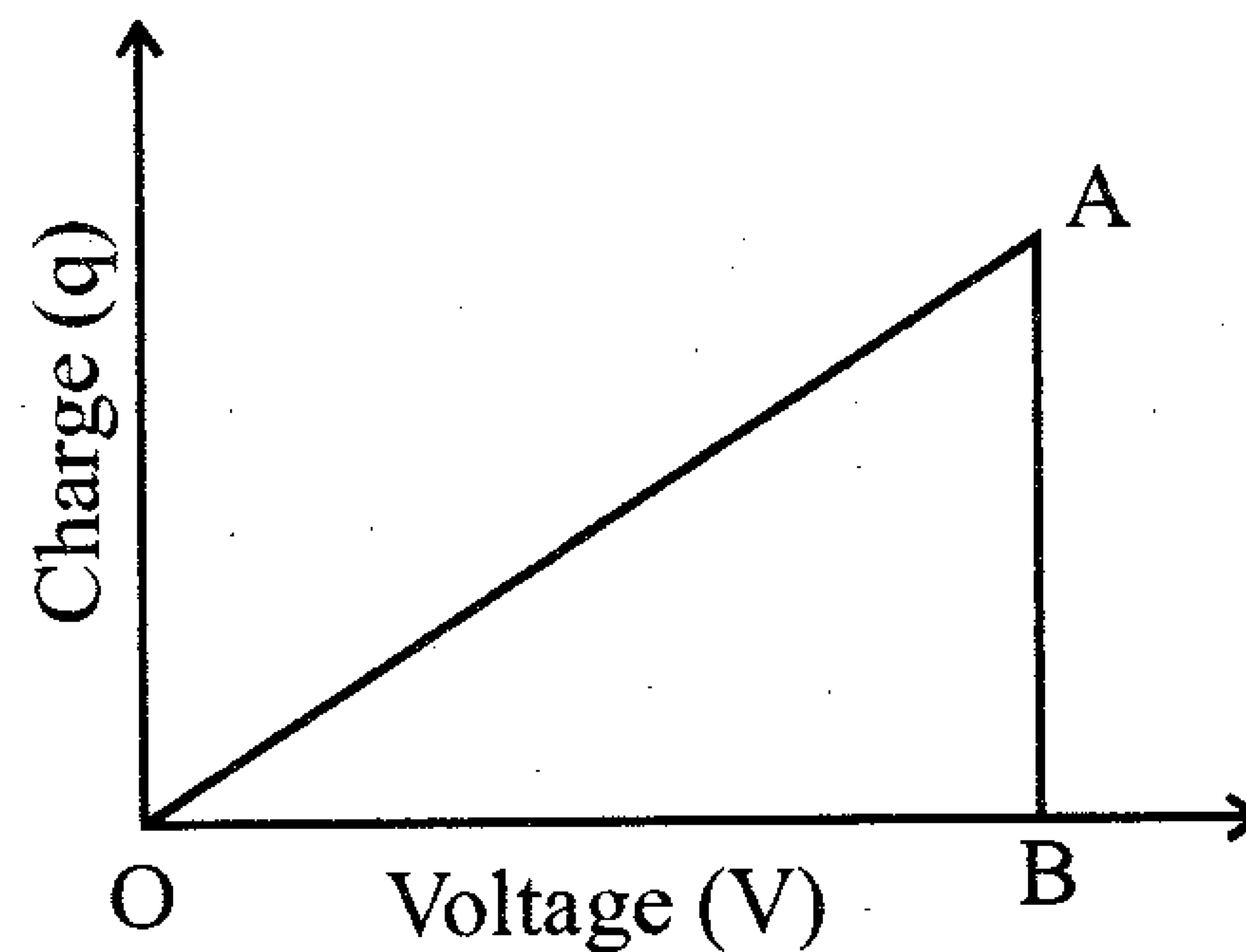
Derive an expression for the equivalent capacitance in

(i) Series and

(ii) Parallel combinations

(Scores : 4)

- (b) The variation of charge (q) on a capacitor with voltage (V) is shown in the figure given below :

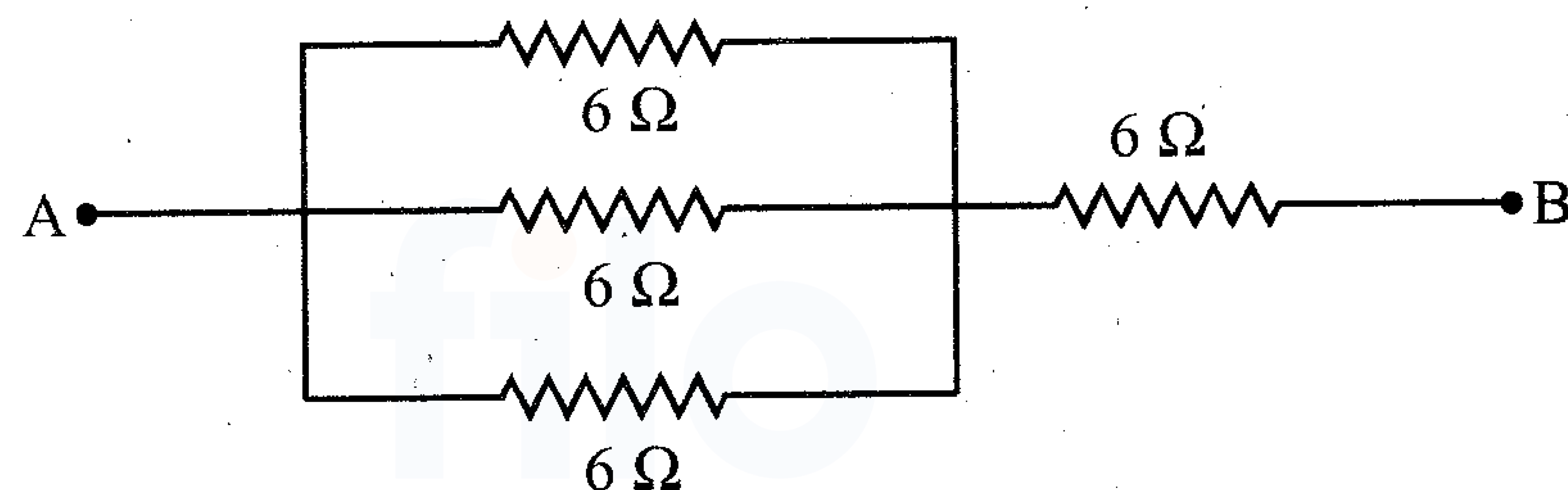


The area of the ΔOAB represents

- (i) Capacitance
- (ii) Capacitive reactance
- (iii) Electric field between the plates
- (iv) Energy stored in the capacitor

(Score : 1)

8. (a) Four equal resistances each of 6 ohms are arranged as shown in the figure given below :



Calculate the total resistance between A and B.

(Scores : 2)

- (b) Table given below shows the current (I) voltage (V) relationship of a device.

Voltage (V)	Current (I)
1	20
2	30
3	35
4	50
5	55
6	68

Draw V-I graph. With the help of the graph explain whether the device is showing ohmic or non-ohmic behaviour.

(Scores : 2)

- (c) Name two devices which do not obey Ohm's law.

(Score : 1)

9. Magnetic materials are broadly classified as diamagnetic, paramagnetic and ferromagnetic.

(a) Mention the behaviour of dia and ferromagnetic materials when they are placed in a non-uniform magnetic field. (Scores : 2)

(b) The temperature at which a ferromagnetic material becomes paramagnetic is

(i) Transition temperature

(ii) Critical temperature

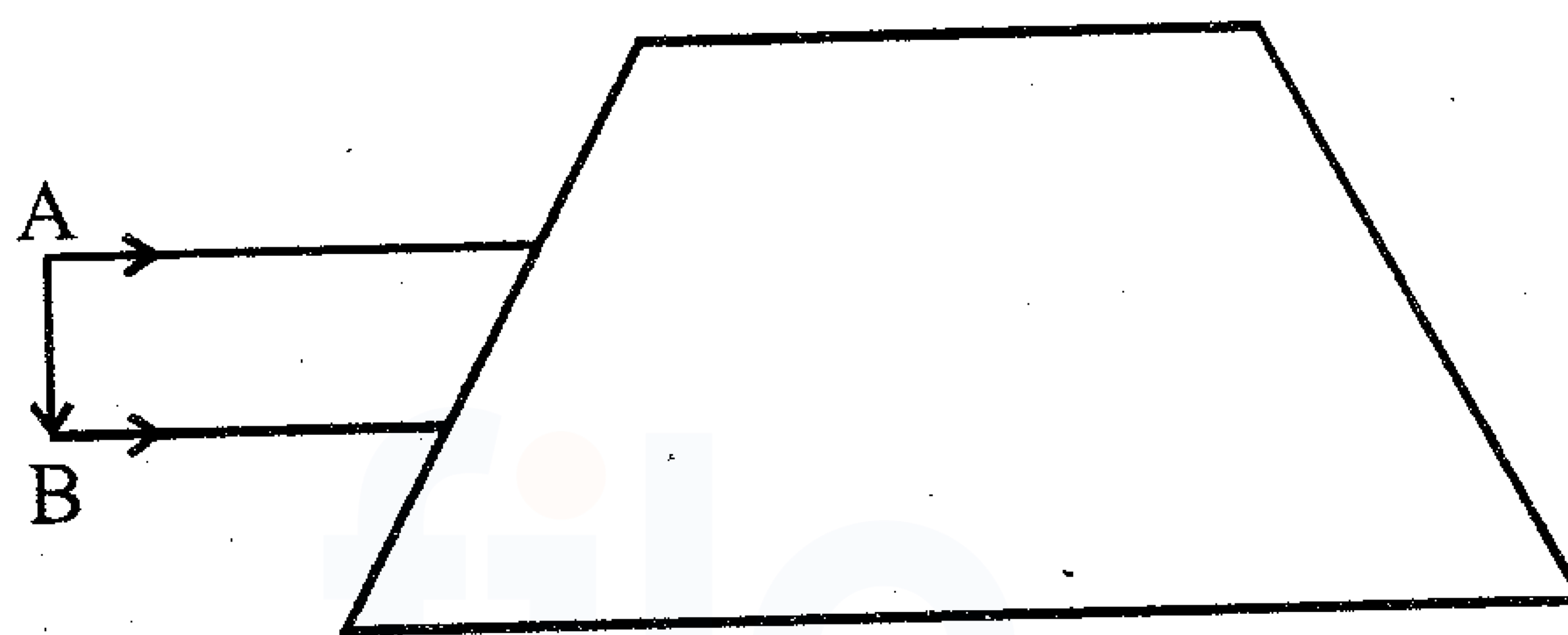
(iii) Curie temperature

(iv) Triple point (Score : 1)

10. The refraction of light through the atmosphere is responsible for many interesting phenomena.

(a) How is the atmospheric refraction of sunlight affects the duration of a day ? (Score : 1)

(b) A prism shown in the figure is designed to bend the rays by 180° .



Complete the ray diagram to show the image formation. (Scores : 2)

The following is a choice question :

11. (A) The wavelength of matter waves is called de Broglie Wavelength.

(a) An α -particle, a proton and an electron having de Broglie wavelengths λ_α , λ_p and λ_e respectively are moving with the same momentum. Then

(i) $\lambda_\alpha > \lambda_p > \lambda_e$

(ii) $\lambda_p > \lambda_e > \lambda_\alpha$

(iii) $\lambda_\alpha = \lambda_p = \lambda_e$

(iv) $\lambda_p = \lambda_e \neq \lambda_\alpha$ (Score : 1)

(b) The de Broglie wavelength of a ball of mass 0.12 kg is 2.76×10^{-34} m. Calculate the speed of the ball.

[$h = 6.625 \times 10^{-34}$ Js] (Scores : 2)

OR

(B) Photoelectric current depends on the intensity of incident light.

(a) The maximum current emitted by a photoelectric material is called

- (i) Emitter current
- (ii) Collector current
- (iii) Saturation current
- (iv) Peak current

(Score : 1)

(b) Work function of caesium and platinum are 2.14 eV and 5.65 eV respectively. Which one of the two metals has higher threshold wavelength ? Justify.

(Scores : 2)

12. The magnifying power of a telescope depends on the focal length of the objective and that of the eye-piece.

(a) Data of some lenses are given in the table.

Lenses	Power	Aperature
L_1	6D	1 cm
L_2	3D	8 cm
L_3	10 D	1 cm

Choose any two lenses which are to be preferred as objective and eye-piece to construct a telescope. Give reason for your selection.

(Scores : 2)

(b) A telescope has an objective of focal length 1.44 m and an eye-piece of focal length 0.06 m. What is the separation between the objective and the eye-piece ?

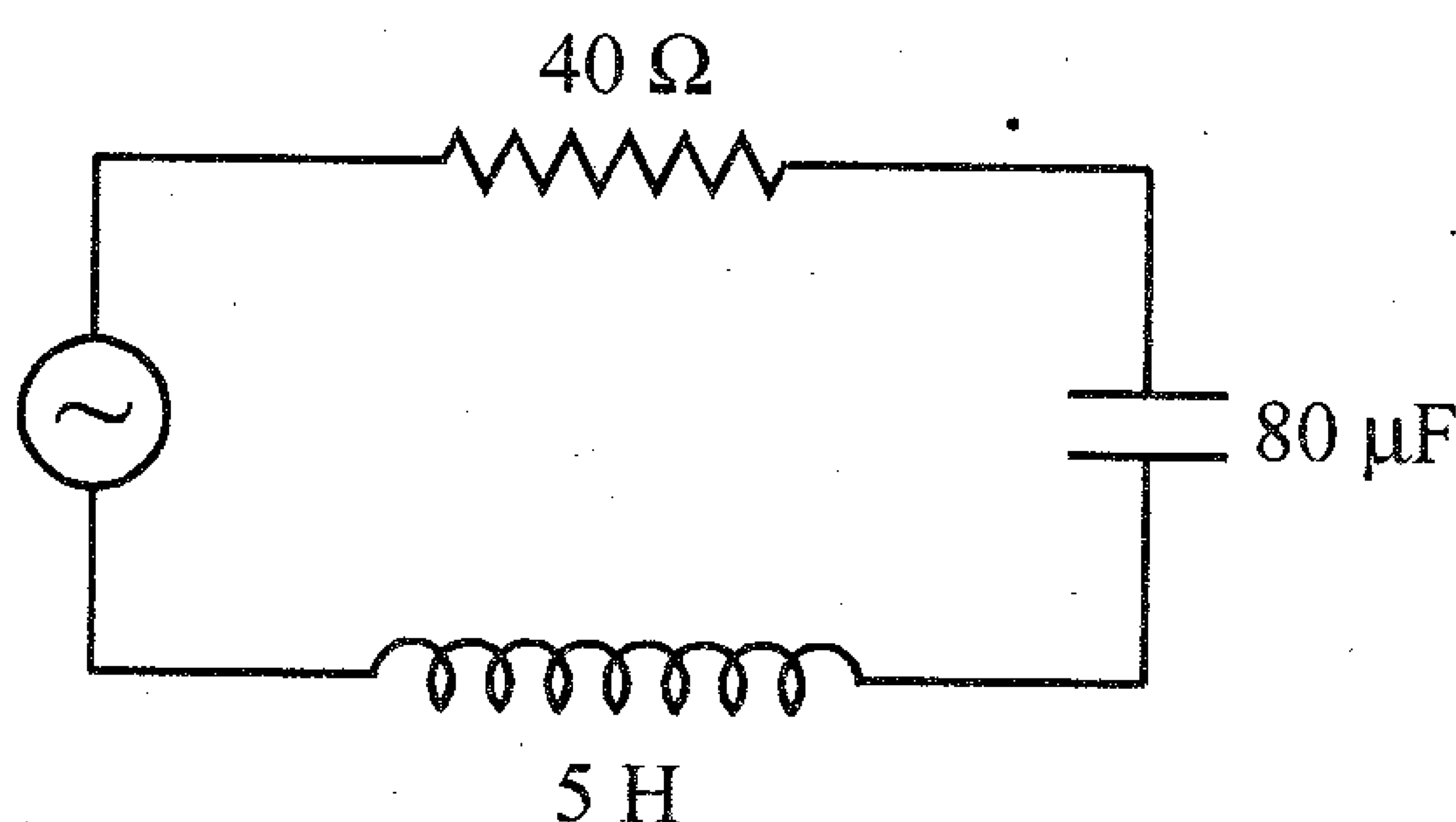
(Scores : 2)

13. (a) The S.I. unit of inductive reactance is

- (i) Henry
- (ii) Ohms
- (iii) Volt
- (iv) No unit

(Score : 1)

(b) Figure given below shows a series LCR circuit connected to a variable frequency source.



Determine the source frequency at resonance.

(Scores : 2)

The following is a choice question :

14. (A) Interference and diffraction of light waves produce alternate dark and bright regions called fringes

(a) Regarding the fringe width choose the correct statement.

(i) Interference fringes are of unequal width.

(ii) Diffraction fringes are of same width.

(iii) Interference fringes are of equal width and diffraction fringes are of different width.

(iv) Both interference and diffraction fringes are of different width. (Score : 1)

(b) Using a schematic diagram derive an expression for the fringe width in Young's double slit experiment.

(Scores : 4)

OR

(B) Huygen's principle help us to find the shape of a wave front emanating from a source.

(a) The shape of the wave front originating from a tube light is

(i) Plain

(ii) Circular

(iii) Cylindrical

(iv) Spherical

(Score : 1)

(b) Give Huygen's principle with the help of a ray diagram. Prove the law of reflection.

(Scores : 4)

15. (a) State Faraday's law of electromagnetic induction. Write its mathematical form.

(Scores : 2)

(b) Name the factors on which the inductance of a coil depends.

(Score : 1)

The following is a choice question :

16. (A) A current carrying conductor produces a magnetic field in the surrounding space.

(a) Name the law which gives the relation between current and the magnitude of the field it produces.

(Score : 1)

(b) Using this law obtain the equation for the magnetic field on the axis of a circular current loop.

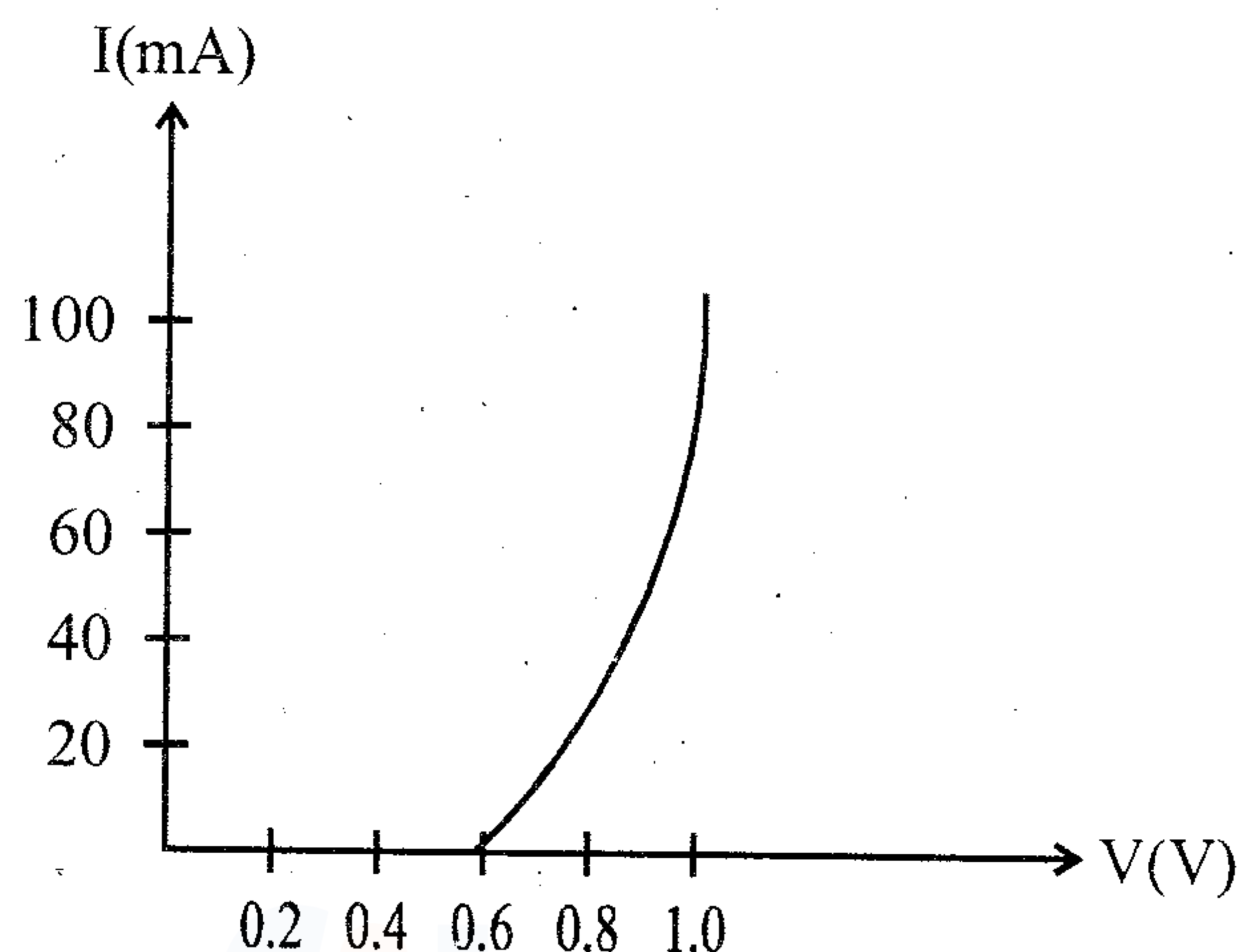
(Scores : 4)

OR

- (B) Depending on the requirement, a moving coil galvanometer can be used as a current detector, an ammeter or a voltmeter.
- (a) Write the principle of a moving coil galvanometer. (Score : 1)
- (b) Using a suitable diagram arrive at an expression for the current sensitivity of a moving coil galvanometer. (Scores : 4)

17. A graph showing the variation of current (I) flowing through a p-n junction with the voltage (V) applied across it is called the V-I characteristic of a p-n junction.

- (a) V-I characteristic of a forward biased diode is shown in the figure.



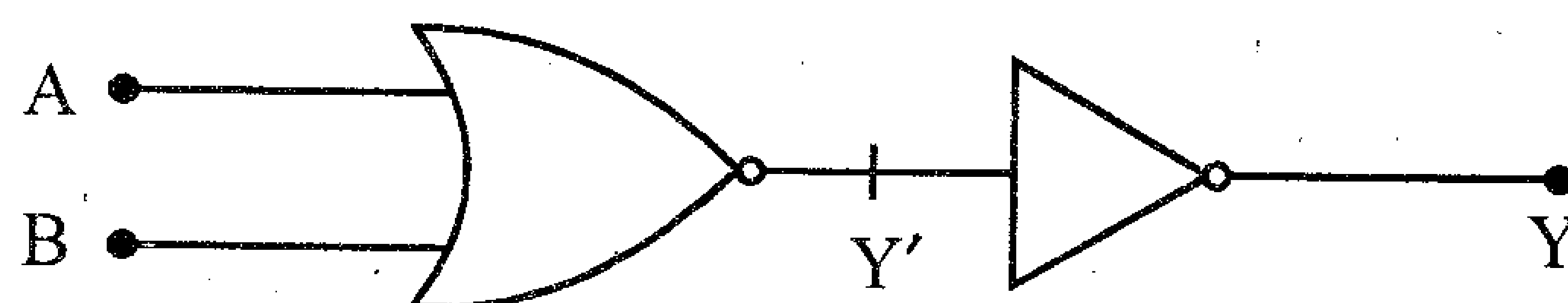
Write any two important features of the graph.

(Scores : 2)

- (b) What is a zener diode ? Give its symbol.

(Scores : 2)

18. A logic circuit is shown in the figure :



Complete the truth table of the circuit :

A	B	Y'	Y
0	0	1	0

Name the resulting gate formed by the combination of the above gates.

(Scores : 2)

SECOND YEAR HIGHER SECONDARY SAY/IMP. EXAMINATION, JUNE 2016.
(Finalised Scheme of Valuation)

Subject: Part III Physics

Code No: 2015

Qn.No	Scoring Indicators	Split Score	Total Score
1	Radio waves → Acceleration of charges in conducting wires → Cellular phones U-V rays → Inner shell electron transition → Detect fake currency notes Any two correct give 2 score	1 Score 1 Score	2 Score
2 a)	Name of any ^{one} Series	1 Score	3 Score
b)	Energy level diagram (Naming of Series not necessary) [Drawing each series 1/2 score]	2 Score	
3	Any option give (1 score) [symbols are not specified]	1 Score	1 Score
4 a) iv)	Independent of γ	1 Score	3 Score
b)	Figure with correct derivation or Statement of Gauss's theorem, or $\oint \vec{E} \cdot d\vec{s} = \frac{q}{\epsilon_0}$ or $\phi = \frac{q}{\epsilon_0}$ or Figure or final equation (1 score)	2 Score 1 Score	
5	modulating signal → ⊕ → [Square law device] → [Band pass filter] → AM wave ↑ carrier wave For labelling each give 1/2 score or Drawing AM wave (2 score)	2 Score	2 Score

Qn.No	Scoring Indicators	Split Score	Total Score
6 A	a) (iii) $f_{pp} = f_{nn} = f_{pn}$ b) Definition or equation or the mass of the nucleus is less than the total mass of its constituents. c) $BE = \Delta mc^2$ or $\Delta m \times 931 \text{ Mev}$ give 1 score. Energy = 23.8336 Mev Unit is not necessary	1 Score 1 Score 1 Score 1 Score	4 Score
6 B	OR a) Definition or eqn b) $N = N_0 e^{-\lambda t}$ or $\frac{m}{m_0} = \left(\frac{1}{2}\right)^n$ ($n = \frac{t}{t_{1/2}}$; no. of half life) $t = 560 \text{ days}$ c) (ii) Neutron	1 Score 1 Score 1 Score 1 Score	4 Score
7 a)	i) Series — Figure 1 score Final equation 1 score ii) parallel — Figure 1 score Final equation 1 score b) (iv) Energy stored in the capacitor	2 score 2 score 1 score	5 score
8	a) (Eqn. for series or parallel give correct answer 8 Ω 2 score)	2 score	

Qn.No	Scoring Indicators	Split Score	Total Score
	b) Graph of any shape 1 Score Non-ohmic behaviour 1 Score c) Any one device 1 Score	2 Score 1 Score	5 Score
9	a) Any one difference between dia and ferro or figure showing Property b) iii) Curie Temperature	2 Score 1 Score	3 Score
10	a) length of the day is longer or (diagram $\frac{1}{2}$ Score) b) For any related attempt give 2 Score	1 Score 2 Score	3 Score
11 ^A	a) (iii) $\lambda_a = \lambda_p = \lambda_e$ b) $\lambda = \frac{h}{m_v}$ or $\lambda = \frac{h}{p}$ (1 Score) Substitution $\frac{1}{2}$ Score Answer $V = 20 \text{ m/s}$ $\frac{1}{2}$ Score unit not necessary	1 Score 2 Score	3 Score
11 ^B	a) (iii) Saturation Current OR b) Definition or $\omega = \frac{hc}{\lambda_0}$ or $h\nu_0$ or $\omega \propto \frac{1}{\lambda_0}$ 1 Score Caesium — 1 Score or Since the work function of Caesium is small, its threshold wavelength is large — 2 Score	1 Score 2 Score	3 Score

Qn.No	Scoring Indicators	Split Score	Total Score
12	a) L_2 — objective — 1 score L_3 — eye piece — 1 score or Focal length of objective is greater than eye-piece or power of eye-piece is greater than objective — 1 score b) The separation between the objective and eye-piece = Length of the telescope or $f_o + f_e$ $= 1.44 + 0.06 = 1.5m$ (Unit not necessary)	2 Score 1 score 1 score	4 score
13	a) (ii) ohms b) $f = \frac{1}{2\pi\sqrt{LC}}$ Substitution $\frac{1}{2}$ score $f = 7.96 Hz$ — $\frac{1}{2}$ score (Unit not necessary)	1 score 1 score 1 score	3 score
14	a) (iii) b) Figure — 1 score Correct derivation — 2 score Final equation — 1 score $B = \frac{\lambda D}{d}$ OR	1 score 4 score	5 score
14	a) (iii) cylindrical b) Huygen's principle Statement or any law of reflection or diagram of reflection of a plane wave	1 score 4 score	5 score

Qn.No	Scoring Indicators	Split Score	Total Score
15	a) Faraday's law of induction Statement — 1 score Equation — 1 score ($\mathcal{E} = \frac{d\phi}{dt}$) b) i) geometry of the coil or material of the coil or No. of turns	2 Score 1 Score	3 score
16 A	a) Biot-Savart's law or Ampere's circuital theorem b) Figure — 1 score Derivation — 2 score Final equation — 1 score (Equation for centre give 1 score)	1 Score 4 Score	5 score
16 B	OR a) Principle or $\mathcal{E}$ or $\mathcal{T} = N I A B \sin \theta$ b) $\mathcal{T} = N I A B$ — 1 score $K\phi = N I A B$ or $\phi = \left(\frac{N I A B}{K}\right)$ — 1 score Current sensitivity is the deflection Per unit current — 1 score $\frac{\phi}{I} = \frac{N A B}{K}$ — 1 score OR Diagram only — 2 score	1 Score 4 Score	5 score
17	a) Any one feature b) Any one property of a Zener diode Symbol. — 1 score	2 score 2 Score	4 Score
18	For truth table NOR + NOT or OR gate	1 score 1 score	2 score