

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 ടെം’ ഉണ്ടായിരിക്കും. ഈ സമയത്ത് ചോദ്യങ്ങൾക്ക് ഉത്തരം എഴുതാനോ, മറ്റൊളവരുമായി ആശയവിനിമയം നടത്താനോ പാടില്ല.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാവുർബ്ബം വായിക്കണം.
- എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം എഴുതണം.
- ഒരു ചോദ്യനും ഉത്തരമെഴുതാൻ തെരഞ്ഞെടുത്തു കഴിഞ്ഞാൽ ഉപചോദ്യങ്ങളും അതേ ചോദ്യനും തന്നെ തെരഞ്ഞെടുക്കേണ്ടതാണ്.
- കണക്ക് കുറുക്കൾ, ചിത്രങ്ങൾ, ശ്രാഹ്യകൾ എന്നിവ ഉത്തരപേപ്പിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നൽകിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കൗലററുകൾ ഒഴികെയുള്ള ഒരു ഖലക്ട്രോണിക് 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  $\sigma$ . Using Gauss's theorem derive the expression for the electric field produced outside the shell.

(Scores : 2)

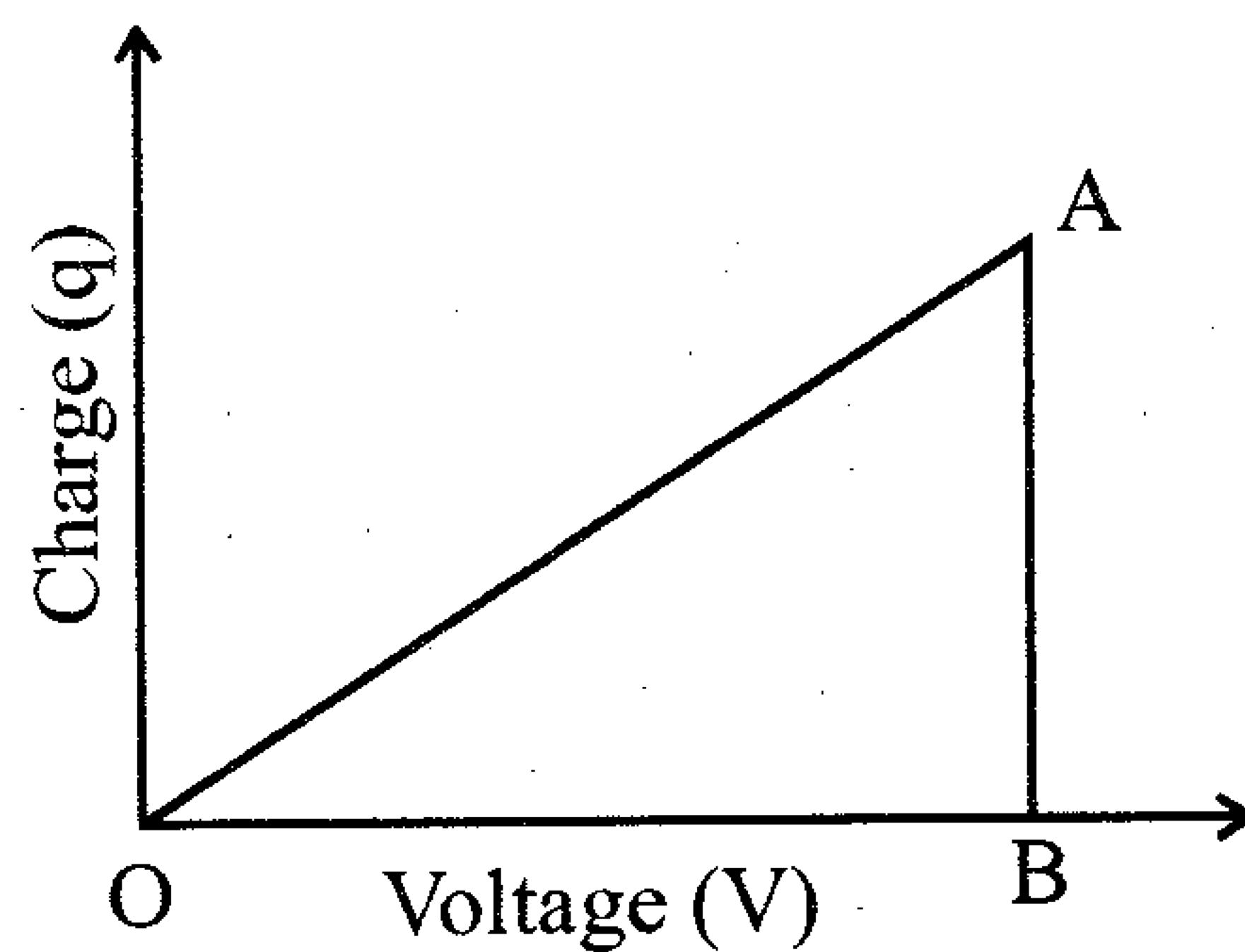
5. Draw the labelled block diagram of an amplitude modulator for obtaining AM wave.

(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 :
- $$_1H^2 + _1H^2 \rightarrow _2He^4 + \text{Energy}$$
- mass of ( $_1H^2$ ) = 2.014102 u
- mass of ( $_2He^4$ ) = 4.0026 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) Deutron      (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 :

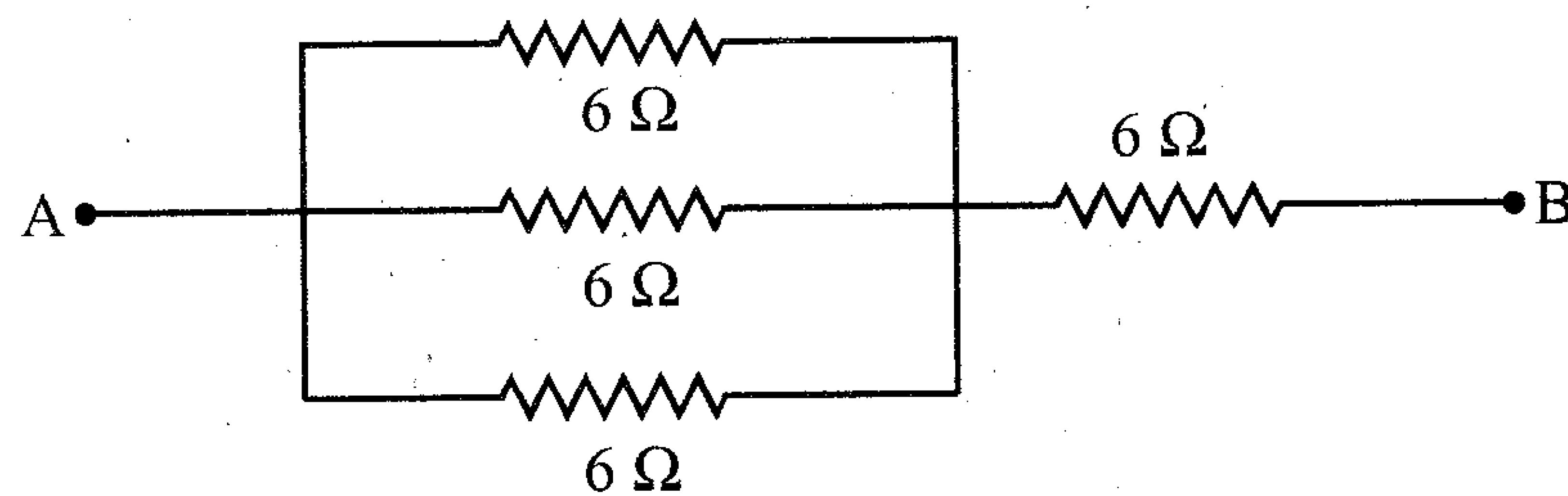


The area of the  $\Delta OAB$  represents

- (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

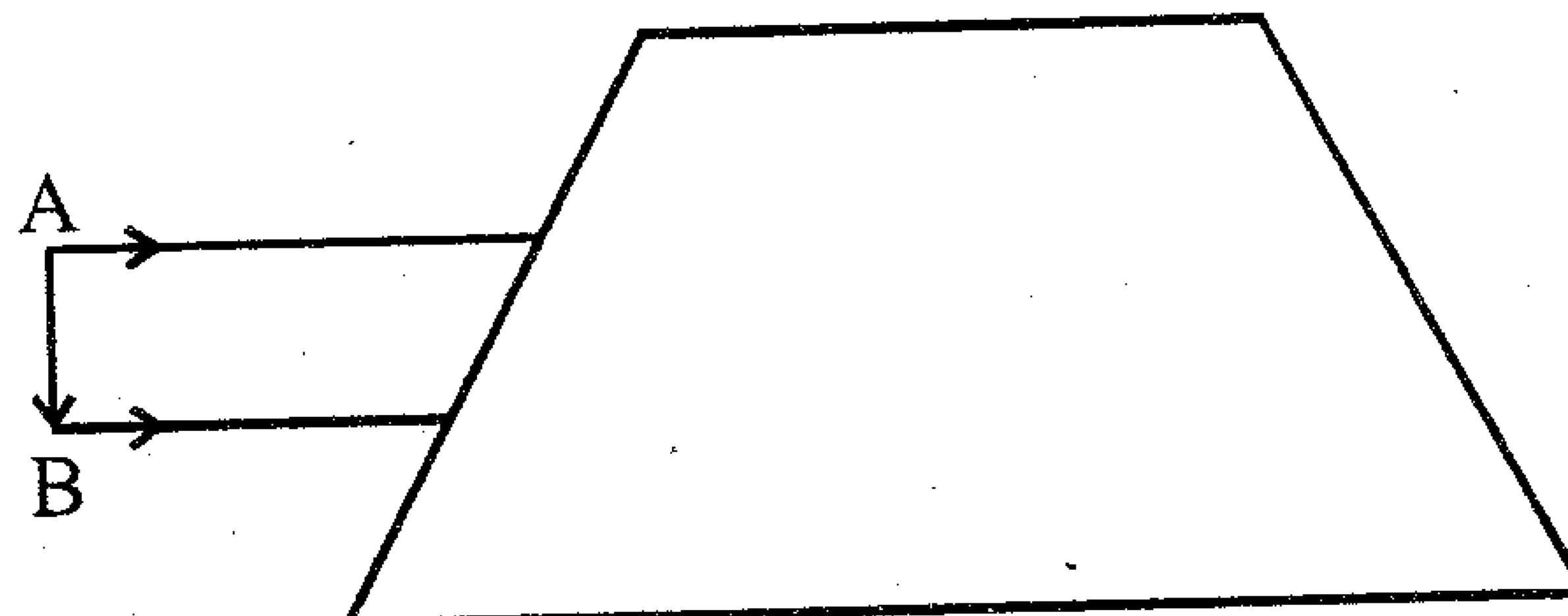
(Score : 1)

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  $180^\circ$ .



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  $\alpha$ -particle, a proton and an electron having de Broglie wavelengths  $\lambda_\alpha$ ,  $\lambda_p$  and  $\lambda_e$  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  $2.76 \times 10^{-34}$  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
- Emitter current
  - Collector current
  - Saturation current
  - 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.

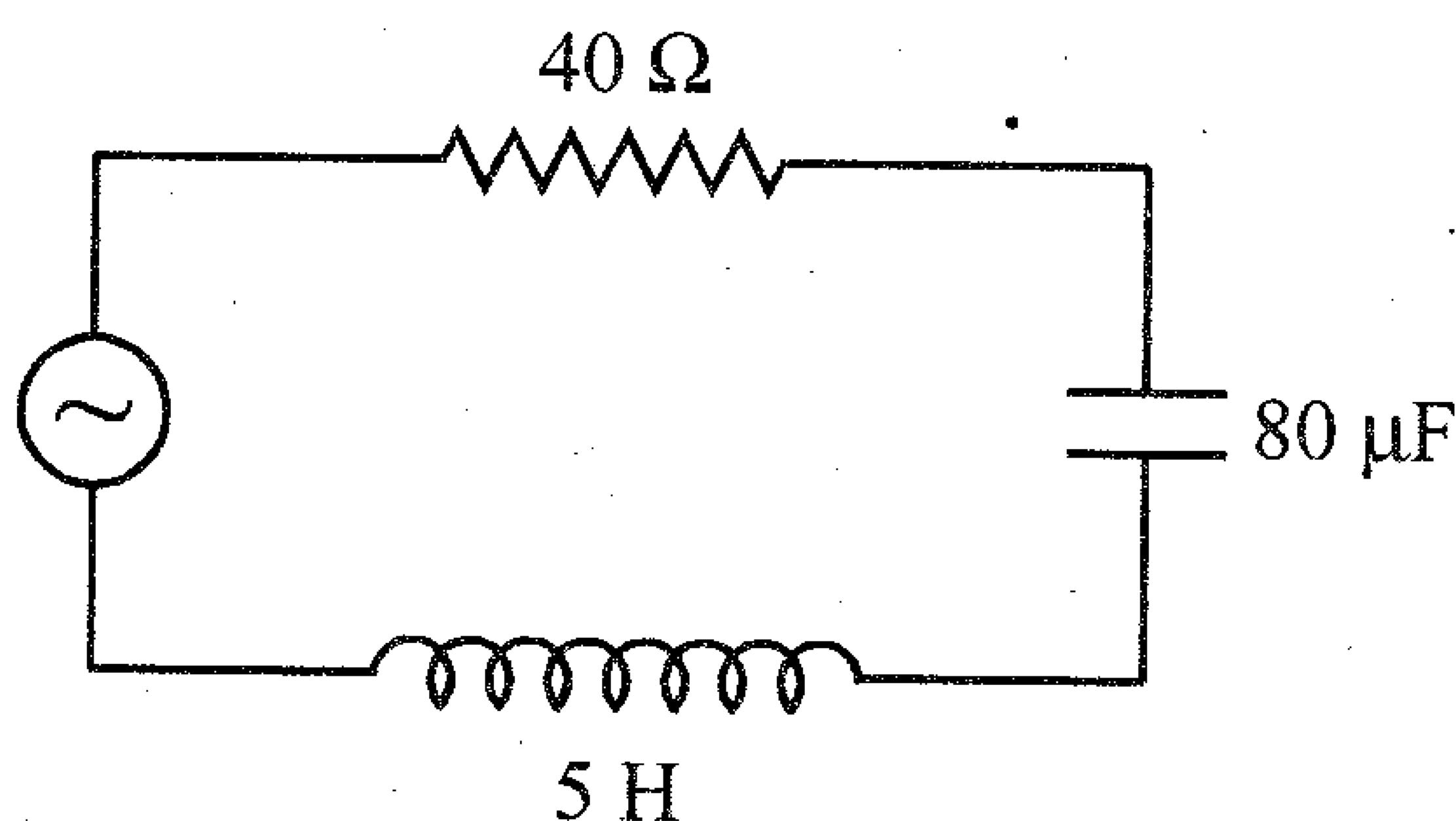
Lenses	Power	Aperature
$L_1$	6D	1 cm
$L_2$	3D	8 cm
$L_3$	10 D	1 cm

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.

(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)**

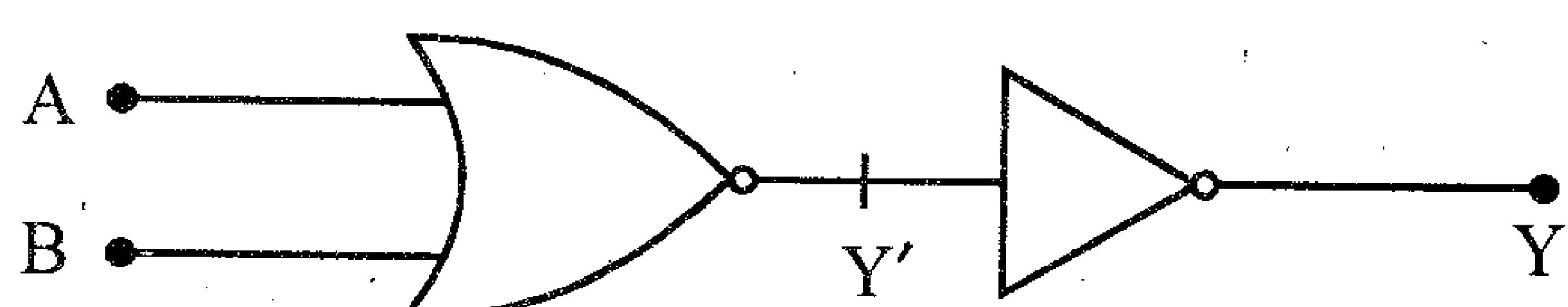
\* (b) Using this law obtain the equation for the magnetic field on the axis of a circular current loop. **(Scores : 4)**

2015

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

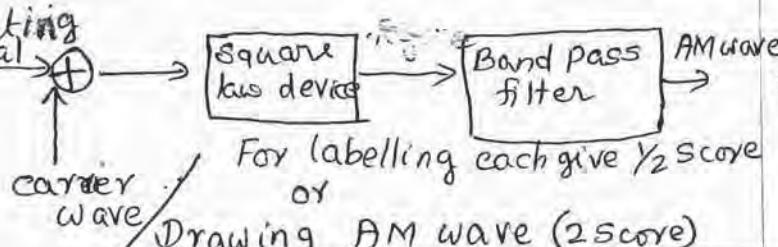
Name the resulting gate formed by the combination of the above gates.

**(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 1 Score	2 Score
2 a)	Name of any <sup>one</sup> series	1 Score	
b)	Energy level diagram (Naming of series not necessary) [Drawing each series ½ score]	3 Score 2 Score	
3	Any option give (1 score) [Symbols are not specified]	1 Score	1 Score
4 a)	iv) Independent of $\tau$	1 Score	
b)	Figure with correct derivation or Statement of Gauss's theorem, or $\oint \mathbf{E} \cdot d\mathbf{s} = \frac{q}{\epsilon_0}$ or $\phi = \frac{q}{\epsilon_0}$ or Figure or final equation (1 score)	2 Score 1 Score	3 Score
5	modulating signal carrier wave →  For labelling each give ½ score or Drawing AM wave (2 score)	2 Score	2 Score

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

Qn.No	Scoring Indicators	Split Score	Total Score
b)	Graph of any shape 1 score Non-ohmic behaviour 1 score	2 score	5 score
c)	Any one device 1 score	1 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) $\lambda_s = \lambda_p = \lambda_e$ b) $\lambda = \frac{h}{m_e}$ 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 3 score 2 score	
B	a) iii) Saturation current. b) Definition or $\omega = \frac{hc}{\lambda_0}$ or $h\nu_0$ or $\omega \propto \frac{1}{\lambda_0}$ 1 score Caesium — 1 score Since the <sup>or</sup> 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	2 score	
	b) The separation between the objective and eye-piece = Length of the telescope or $f_o + f_e$ $= 1.44 + 0.06 = 1.5 \text{ m}$ (Unit not necessary)	1 score 1 score	4 score
13	a) (iii) ohms b) $f = \frac{1}{2\pi\sqrt{LC}}$ Substitution $\frac{1}{2}$ score $f = 7.96 \text{ Hz}$ — $\frac{1}{2}$ score (Unit not necessary)	1 score 1 score	3 score
14 A)	a) (iii) b) Figure — 1 score correct derivation — 2 score final equation — 1 score $B = \frac{\lambda D}{d}$	1 score 5 score	
14 B)	a) (iii) cylindrical b) Huygen's principle statement 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 $(E = \frac{d\phi}{dt})$ b) i) geometry of the coil or material of the core 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	a) Principle or $\text{Torq} \propto$ or $T = NIA\sin\theta$ — 1 score b) $T = NIA B$ — 1 score $k\phi = NIA B$ or $\phi = \frac{(NIA B)}{K}$ — 1 score Current sensitivity is the deflection Per unit current — 1 score $\frac{\phi}{I} = \frac{NAB}{K} — 1 score$ or Diagram only — 2 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