Section A

1 A long cylinder of radius R carries a current distributed uniformly over its cross-section. The magnitude of the magnetic field is:

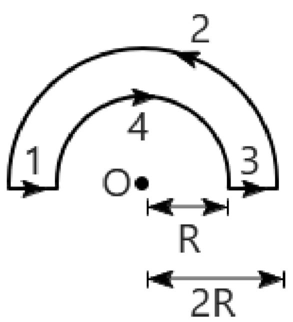
1.	maximum at the axis of the cylinder
2.	maximum at the surface of the cylinder
3.	maximum at infinite distance from it
4.	minimum at the surface

2 Given below are two statements:

Assertion (A):	Absolute potential at any point is meaningful only when some reference level for the potential is defined.
Reason (R):	The capacitance of any parallel plate capacitor depends on the charge on the capacitor and the voltage applied across the plates.

1.	Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
2.	Both **(A)** and **(R)** are true but **(R)** is not the correct explanation of **(A)**.
3.	**(A)** is true but **(R)** is false.
4.	Both **(A)** and **(R)** are false.

3 The figure shows a current carrying loop having four segments 1, 2, 3 and 4. The magnitude of the magnetic field at centre O is maximum due to:



1. segment 1
2. segment 2
3. segment 3
4. segment 4

4 Which of the following particles will experience maximum magnetic force (magnitude) when projected with the same velocity perpendicular to a magnetic field?
1. electron
2. proton
3. He^{+}
4. Li^{++}

5 A copper wire of length 10 m and radius $\left(10^{-2}/\sqrt{\pi}\right)$ m has an electrical resistance of 10 Ω. The current density in the wire for an electric field strength of 10 (V/m) is:
1. 10^5 A/m^2
2. 10^4 A/m^2
3. 10^6 A/m^2
4. 10^{-5} A/m^2

6 There are four light-weight-rod samples A, B, C, D separately suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted:

i.	A is feebly repelled.
ii.	B is feebly attracted.
iii.	C is strongly attracted.
iv.	D remains unaffected.

Which one of the following is true?

1.	C is of a diamagnetic material.
2.	D is of a ferromagnetic material.
3.	A is of a non-magnetic material.
4.	B is of a paramagnetic material.

7 A parallel plate capacitor (C) is charged by connecting it to a battery (emf E). A dielectric slab is inserted into the space between the plates.

(I)	The charge on the plates increases.
(II)	The energy stored in the capacitor increases.
(III)	Work is done by the battery as the slab is inserted.

Choose the correct option:

1.	I, II are true
2.	I, and III are true
3.	only I is true
4.	I, II, and III are true

8 Regarding moving coil galvanometer incorrect statement is:

1.	a spring in a galvanometer provides a counter torque that balances magnetic torque.
2.	a galvanometer has many turns of wire to increase torque on the loop.
3.	in all positions field B is parallel to the plane of the coil.
4.	deflection ϕ indicated by scale is proportional to square of the current flowing in the coil.

9 Given below are two statements:

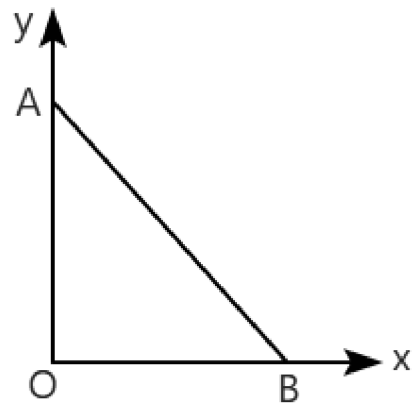
Statement I:	The law of conservation of energy is valid in electric circuits.
Statement II:	Kirchhoff's junction law is applicable to electric circuits.

1.	Statement I and Statement II are true and Statement I is the correct explanation of Statement II.
2.	Statement I and Statement II are true and Statement I is not the correct explanation of Statement II.
3.	Statement I is true, Statement II is false.
4.	Statement I is false, Statement II is true.

10 N capacitances, C each, are available to be connected in series or in parallel. The ratio of the minimum (C_{min}) and maximum (C_{max}) capacitance that can be formed from these is $\frac{C_{max}}{C_{min}} =$

1. N
2. N^2
3. N^3
4. $\sqrt{N}$

11 As per the figure a point charge $+q$ is placed at the origin O. Work done in taking another point charge $-Q$ from the point A(0, a) to another point B(a, 0) along the straight path AB is:

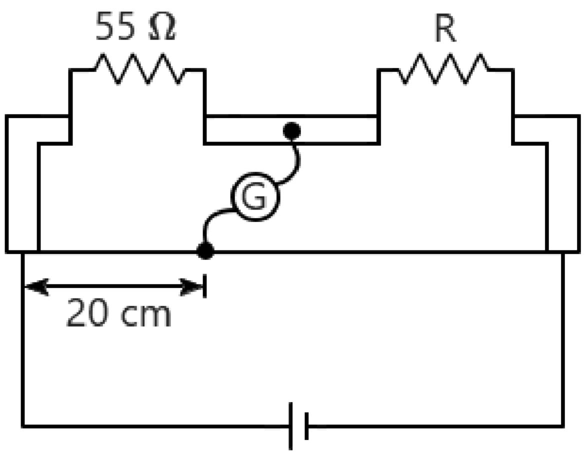


1. $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a}\right)\sqrt{2}$
2. $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a}\right)\sqrt{2}$
3. $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a}\right)\frac{1}{\sqrt{2}}$
4. zero

12 Two hollow conducting spheres of radii R_1 and R_2 $(R_1 \gg R_2)$ have equal charges. The potential would be:

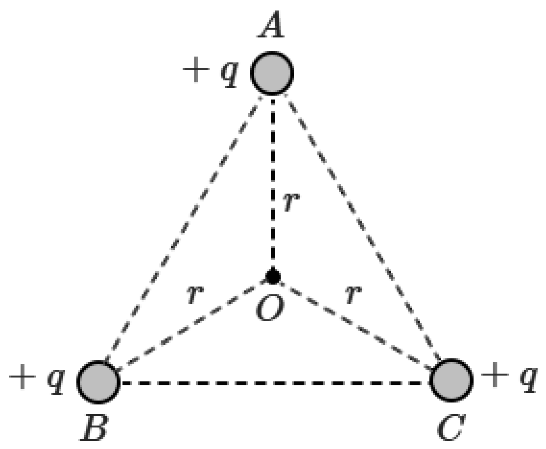
1.	dependent on the material property of the sphere
2.	more on bigger sphere
3.	more on smaller sphere
4.	equal on both the spheres

13 The following figure shows a meter bridge set up with null deflection in the galvanometer. The value of the unknown resistor R is:



1. 13.75 Ω
2. 220 Ω
3. 110 Ω
4. 55 Ω

14 ABC is an equilateral triangle. Charges $+q$ are placed at each corner. The electric intensity at O will be:



1. $\frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$
2. $\frac{1}{4\pi\epsilon_0}\frac{q}{r}$
3. zero
4. $\frac{1}{4\pi\epsilon_0}\frac{3q}{r^2}$

15 A secondary cell after long use has an emf of 1.9 V and a large internal resistance of 380 Ω. What maximum current can be drawn from the cell?
1.0.05 A
2. 0.005 A
3. 5.0 A
4. 0.5 A

16 The electric field at the surface of a black box indicates that the net outward flux through the surface of the box is 8.0×10^3 N-m^2/C. What is the net charge inside the box?
1. 1.01 μC
2. 0.01 μC
3. 0.03 μC
4. 0.07 μC

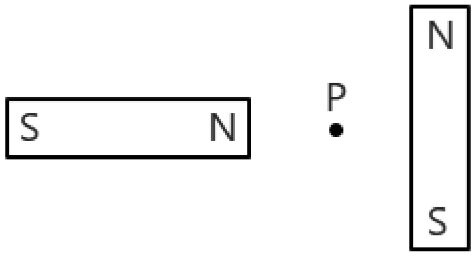
17 A metallic sphere of radius R is given a charge Q. The energy stored in the sphere due to this charge is:
1. $\frac{Q^2}{4\pi\varepsilon_0 R}$
2. $\frac{2Q^2}{4\pi\varepsilon_0 R}$
3. $\frac{1}{2}\frac{Q^2}{4\pi\varepsilon_0 R}$
4. $\frac{Q^2}{16\pi\varepsilon_0 R}$

18 Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon:

1.	the currents in the two coils
2.	the rates at which currents are changing in the two coils
3.	the relative position and orientation of the two coils
4.	both (1) and (2)

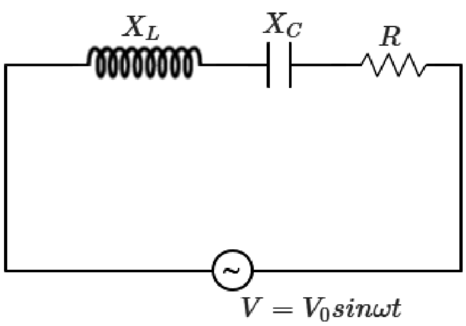
19 The ratio of the magnitude of the magnetic field and electric field intensity of a plane electromagnetic wave in free space of permeability μ_0 and permittivity ε_0 is: (Given that $c =$ velocity of light in free space)
1. c
2. $\frac{1}{c}$
3. $\frac{c}{\sqrt{\mu_0\varepsilon_0}}$
4. $\frac{\sqrt{\mu_0\varepsilon_0}}{c}$

20 Two identical bar magnets are kept as shown in the figure. The direction of the resultant magnetic field, indicated by the arrowhead at the point P is:



1.	
2.	
3.	
4.	

21 A series LCR circuit is as shown in the figure:

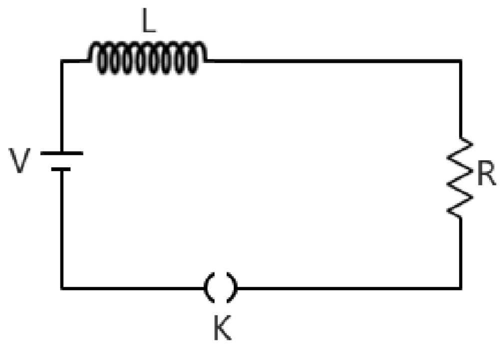


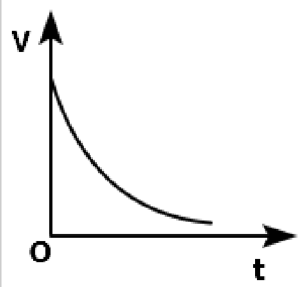
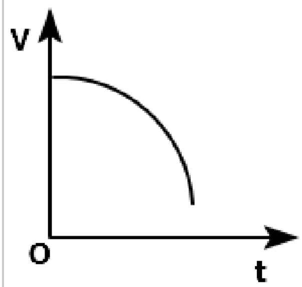
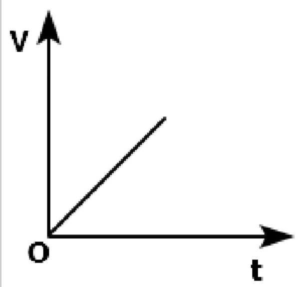
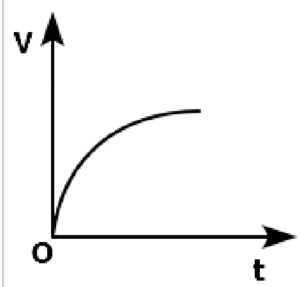
The given values are:
$V_0 = 200$ V, $\omega = 100$ rad/s, $X_L = 100\ \Omega$
$X_C = 100\ \Omega$ and $R = 100\ \Omega$
For the given set of values, the Q-factor of the circuit is:
1. 1
2. 1.5
3. 2
4. 2.5

22 A square loop of side 1 m and resistance 1 Ω is placed in a magnetic field of 0.5 T. If the plane of the loop is perpendicular to the direction of the magnetic field, the magnetic flux through the loop is:
1. 0
2. 2 weber
3. 0.5 weber
4. 1 weber

23 In a series LCR circuit, the resistance of resistor is 300 Ω, inductance is 0.9 H and capacitance is 2 μF. If the source angular frequency is 1000 rad/s, the impedance of the circuit is:
1. 300 Ω
2. 500 Ω
3. 900 Ω
4. 1250 Ω

24 Which one of the graphs shown in the option represents the variation of potential difference V across the inductor L with time t, the key K being plugged at $t = 0$, in the circuit shown in the adjacent figure?



1.		2.	
3.		4.	

25 A cycle wheel of radius 0.5 m is rotated with a constant angular velocity of 10 rad/s in a region of a magnetic field of 0.1 T which is perpendicular to the plane of the wheel. The EMF generated between its centre and the rim is:
1. 0.25 V
2. 0.125 V
3. 0.5 V
4. zero

26 In which of the following decays the atomic number decreases?
(a) α -decay
(b) β^+ -decay
(c) β^- -decay
(d) γ -decay
Choose the correct option:
1. (a), (b)
2. (b), (c)
3. (c)
4. (a), (d)

27 In Young's-double slit experiment, the distance between the slits and the screen is doubled. The separation between the slits is reduced to half. As a result the fringe width:
1. is halved
2. become four times
3. remains unchanged
4. is doubled

28 A small candle, 2.5 cm in size is placed at 27 cm in front of a concave mirror of radius of curvature 36 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image?

1.	54 cm away from the mirror
2.	64 cm towards the mirror
3.	40 cm away from the mirror
4.	44 cm towards the mirror

29 Photons of light of wavelength, $\lambda = 400$ nm are incident on a composite photocathode consisting of multiple regions with metals having work functions of 2.1 eV and 1.1 eV. The emitted photoelectrons are sent through a retarding potential difference, V_o. What is the minimum value of V_o required to stop all electrons? (Take: $hc = 1240$ eV-nm)
1. 1 V
2. 1.5 V
3. 2 V
4. 5.2 V

30 The near point of a hypermetropic person is 75 cm from the eye. What is the power of the lens required to enable the person to read clearly a book held at 25 cm from the eye?
1. $+2.67$ D
2. -1.25 D
3. -2.67 D
4. $+1.25$ D

31 If $f = 0.5$ m for a glass lens, what is the power of the lens?
1. $+0.4$ D
2. $+4.0$ D
3. $+0.2$ D
4. $+2.0$ D

32 The radius of the innermost electron orbit of a hydrogen atom is 5.3×10^{-11} m. What is the radius of the $n = 2$ orbit?
1. 1.67 $\mathring{A}$
2. 4.77 $\mathring{A}$
3. 2.12 $\mathring{A}$
4. 3.11 $\mathring{A}$

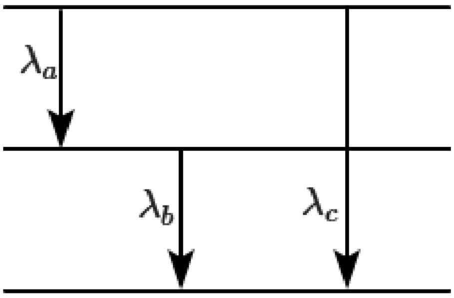
33 A linearly polarized monochromatic light of intensity 10 lumen is incident on a polarizer. The angle between the direction of polarization of the light and that of the polarizer such that the intensity of output light is 2.5 lumen is:
1. 60°
2. 75°
3. 30°
4. 45°

34 A convex lens is made of a material having refractive index 1.2. Both the surfaces of the lens are convex. If it is dipped into water ($\mu = 1.33$), it will behave like:
1. a convergent lens
2. a divergent lens
3. a rectangular slab
4. a prism

35 The work function of a metal is $h\nu_0$. Light of frequency ν falls on this metal. The photoelectric effect will take place only if:
1. $\nu \geq \nu_0$
2. $\nu > 2\,\nu_0$
3. $\nu < \nu_0$
4. $\nu < \nu_0/2$

Section B

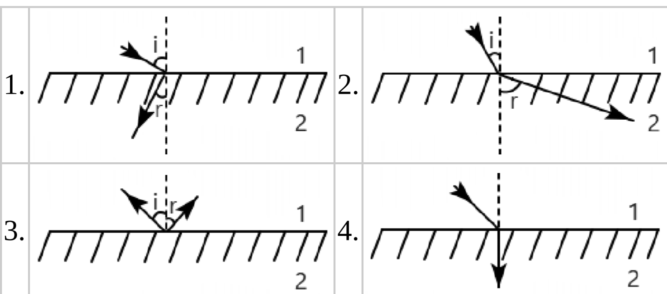
36 In the figure shown, the wavelength and frequency of photons in transition a, b and c for hydrogen atoms are $\lambda_a, \lambda_b, \lambda_c$ and ν_a, ν_b and ν_c respectively, then:



1. $\nu_b = \nu_a + \nu_c$
2. $\nu_c = \nu_a + \nu_b$
3. $\nu_c = \frac{\lambda_a \nu_a + \lambda_b \nu_b}{\lambda_a \nu_c}$
4. $\lambda_b = \frac{\lambda_a \lambda_c}{\lambda_a + \nu_c}$

37 The radionuclide ${}^{11}_{6}C$ decays according to
${}^{11}_{6}C \rightarrow {}^{11}_{5}B + e^{+} + \nu : \quad (T_{1/2} = 20.3\ min)$
The maximum energy of the emitted positron is 0.960 MeV.
Given the mass values:
$m\,({}^{11}_{6}C)$ = 11.011434 u and $m\,({}^{11}_{6}B)$ = 11.009305 u,
the value of Q is:
1. 0.313 MeV
2. 0.962 MeV
3. 0.414 MeV
4. 0.132 MeV

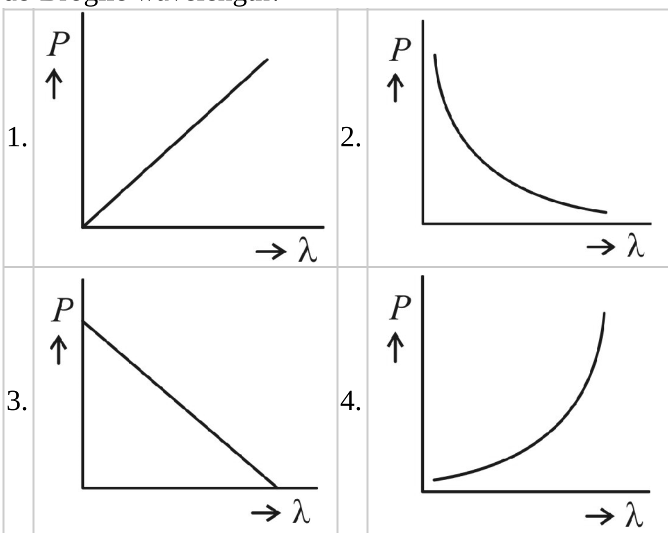
38 There are certain materials developed in laboratories that have a negative refractive index (figure). A ray incident from the air (medium-1) into such a medium (medium-2) shall follow a path given by:



39 Two transparent media A and B are separated by a plane boundary. The speed of light in those media are 1.5×10^{8} m/s and 2.0×10^{8} m/s, respectively. The critical angle for a ray of light for these two media is:
1. $\tan^{-1}(0.750)$
2. $\sin^{-1}(0.500)$
3. $\sin^{-1}(0.750)$
4. $\tan^{-1}(0.500)$

40 If $\lambda_X, \lambda_I, \lambda_M$ and λ_γ are the wavelengths of X-rays, infrared rays, microwaves and γ-rays respectively, then:
1. $\lambda_\gamma < \lambda_X < \lambda_I < \lambda_M$
2. $\lambda_M < \lambda_I < \lambda_X < \lambda_\gamma$
3. $\lambda_X < \lambda_\gamma < \lambda_M < \lambda_I$
4. $\lambda_X < \lambda_I < \lambda_\gamma < \lambda_M$

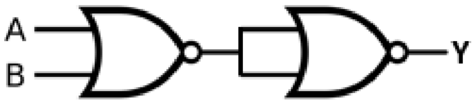
41 Which of the following figures represent the variation of the particle momentum and the associated de-Broglie wavelength?



42 Light of wavelength λ is just able to cause the emission of photoelectrons from a metallic surface. If the metallic surface moves relative to the light source with a velocity v, it will be able to cause photoemission if:

1.	the surface moves away from the light source.
2.	the surface moves towards the light source.
3.	the light source moves away from the surface.
4.	both light source and surface move away from each other.

43 The output of the logic circuit shown is equivalent to a/an:



1. OR gate
2. NOR gate
3. AND gate
4. NAND gate

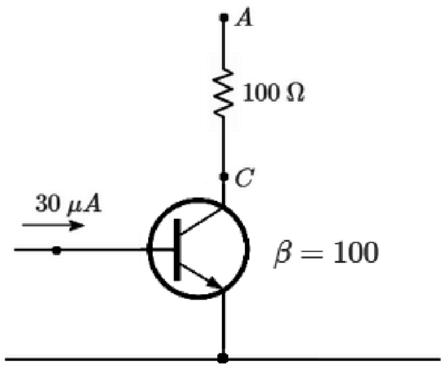
44 A p-n photodiode is fabricated from a semiconductor with a bandgap of 2.8 eV. The energy of the incident photon with a wavelength of 6000 nm is:
1. 0.207 eV
2. 0.270 eV
3. 0.027 eV
4. 0.072 eV

45 The correct relation for α, β for a transistor, is:
1. $\beta = \frac{1-\alpha}{\alpha}$
2. $\beta = \frac{\alpha}{1-\alpha}$
3. $\alpha = \frac{\beta-1}{\beta}$
4. $\alpha\beta = 1$

46 When a p-type semi-conductor is put in an electric field $\vec{E}$ the electrons in the valence band, on average,

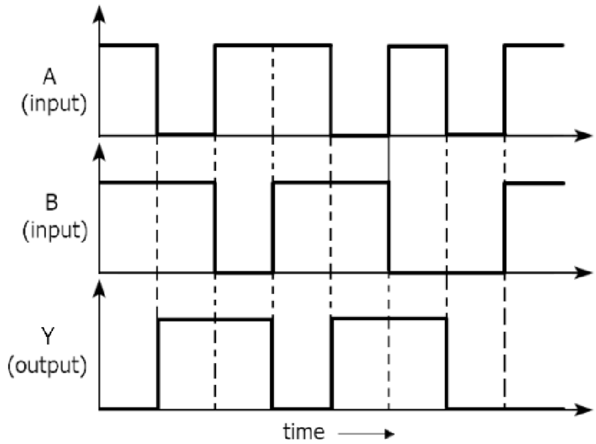
1.	flow in the direction of the $\vec{E}$ and cause a current opposite to $\vec{E}$
2.	flow opposite to $\vec{E}$ and cause a current along $\vec{E}$
3.	flow along $\vec{E}$ and cause a current along $\vec{E}$
4.	flow opposite to $\vec{E}$ and cause a current opposite to $\vec{E}$

47 In the circuit shown in the diagram given below, the potential difference across the 100 Ω resistor is:
(Assuming that the transistor is amplifying)



1. 30 V
2. 3 V
3. 0.3 V
4. 3 mV

48 The two inputs (A) and (B) of a logic circuit are shown along with the output (Y) as functions of time. The 'highs' represent logic 1 and the 'lows' represents logic 0. The correct truth table for this circuit is:



1.

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	0

2.

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	0

3.

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

4.

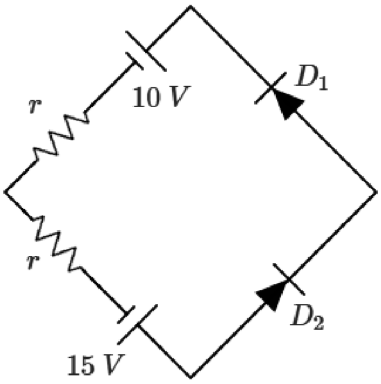
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

49 Given below are two statements:

Assertion (A):	The temperature coefficient of resistance is positive for metals and negative for p-type semiconductors.
Reason (R):	The effective charge carriers in metals are negatively charged whereas in p-type semiconductors they are positively charged.

1.	Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
2.	Both **(A)** and **(R)** are true but **(R)** is not the correct explanation of **(A)**.
3.	**(A)** is true but **(R)** is false.
4.	Both **(A)** and **(R)** are false.

50 In the circuit shown in the adjacent diagram, D_1, D_2 are ideal diodes and r's are small resistances. Then:



1.	no current flows in the circuit
2.	current flows anticlockwise
3.	current flows clockwise
4.	current only flows through D_2 and not through D_1

Fill OMR Sheet*

*If above link doesn't work, please go to test link from where you got the pdf and fill OMR from there. After filling the OMR, you would get answers and explanations for the questions in the test.