विघ्न विचारत भीरु जन, नहीं आरम्भे काम,
विपति देख छोड़े तुरंत मध्यम मन कर श्याम।
पुरुष सिंह संकल्प कर, सहते विपति अनेक,
'बना' न छोड़े ध्येय को, रघुबर राखे टेक।।

रचितः मानव धर्म प्रणेता
सद्गुरु श्री रणछोड़दासजी महाराज

CURRENT ELECTRICITY

Some questions (Assertion–Reason type) are given below. Each question contains STATEMENT – 1 (Assertion) and STATEMENT – 2 (Reason). Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct. So select the correct choice :

Choices are :

(A) Statement – 1 is True, Statement – 2 is True; Statement – 2 **is** a correct explanation for Statement – 1.
(B) Statement – 1 is True, Statement – 2 is True; Statement – 2 **is NOT** a correct explanation for Statement – 1.
(C) Statement – 1 is True, Statement – 2 is False.
(D) Statement – 1 is False, Statement – 2 is True.

438. **STATEMENT – 1**
Voltmeter always gives emf of a cell if it is connected across the terminals of a cell.

STATEMENT – 2
Terminal potential of a cell is given by V = E – ir.

439. **STATEMENT – 1**
If there is current in a wire potential drop has to be there.

STATEMENT – 2
If potential drop is zero, the resistance may be zero.

440. **STATEMENT – 1**
Kirchhoff's laws cannot be applied in circuits with inductors.

STATEMENT – 2
Kirchoff's laws can be applied in circuits with capacitors.

441. **STATEMENT – 1**
In a wire of non–uniform cross–section, the current is the same everywhere.

STATEMENT – 2
The current in a wire is due to the drift of electrons along the wire.

442. **STATEMENT – 1**
A voltmeter is an inherently inaccurate instrument.

STATEMENT – 2
A voltmeter is always connected in parallel in a circuit.

443. **STATEMENT – 1**
In a purely capacitive circuit, the capacitor would be charged instantaneously.

STATEMENT – 2
Ohm × farad = second.

444. **STATEMENT – 1**

Electric field is present in the vicinity of a current carrying wire.

STATEMENT – 2
The principle of conservation of charge of charge is not followed, when charges are in motion.

445. **STATEMENT – 1**
Constant potential difference is applied across a conductor. If temperature of conductor is increases, drift speed of electrons will decrease.

STATEMENT – 2
Resistivity increases with increase in temperature.

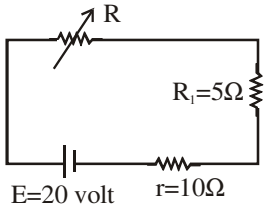
446. **STATEMENT – 1**
Two bulbs of 25W and 100W rated at 200V are connected in series across 200V supply. Ratio of powers of both the bulb in series is 2 : 1.

STATEMENT – 2
In series current in both bulbs is same, therefore power depends on resistance of bulb.

447. **STATEMENT – 1 :** If potential difference between two points is zero and resistance between those points is zero, current may flow between the points.

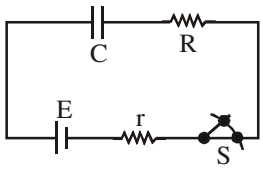
STATEMENT – 2 : Kirchhoff's 1st law is based on conservation of charge.

448. **STATEMENT – 1 :** For zero value of R in circuit power transfer in external resistance will be maximum.



STATEMENT – 2 : Since $R_l < r$ in the given circuit. So, power transfer in external resistance will be maximum when R = 0.

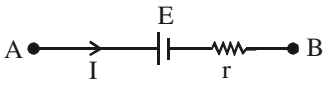
449. **STATEMENT – 1 :** The switch S shown in the figure is closed at t = 0. Initial current flowing through battery is $\frac{E}{R+r}$.



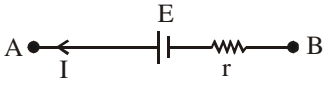
STATEMENT – 2 : Initially capacitor was uncharged, so resistance offered by capacitor at t = 0 is zero.

450. **STATEMENT – 1 :** Consider the two situations shown in the figure. Potential difference between points A and B, in case I is more as compared to case II.

STATEMENT – 2 : In case I $V_A - V_B = E + Ir$
In case II $V_A - V_B = E - Ir$



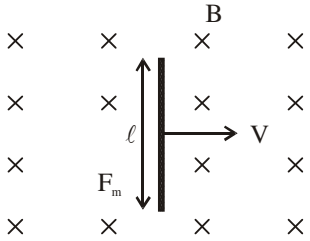
Case I



Case II

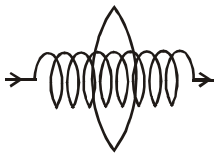
451. **STATEMENT – 1 :** A conducting wire is moved with constant velocity in a uniform magnetic field. A current is induced in the wire.

STATEMENT – 2 : As wire is moving in magnetic field so emf is induced across the wire $\varepsilon = B\ell V$.



452. **STATEMENT – 1 :** A time varying electric current is flowing through a solenoid. A conducting ring is placed coaxially with the solenoid. A current is induced in the ring.

STATEMENT – 2 : As a time varying current is flowing through a solenoid, the magnetic flux associated with ring is changing.



453. **STATEMENT – 1 :** Electric field outside the conducting wire which carries a constant current is zero.

STATEMENT – 2 : Net charge on conducting wire is zero.

454. **STATEMENT – 1 :** Since all the current coming to our house returns to power house. (Since current travels in a closed loop). So there is no need to pay the electricity bill.

STATEMENT – 2 : The electricity bill is paid for the power used not for the current used.

455. **STATEMENT – 1 :** A conductor carrying electric current becomes electrically charged.

STATEMENT – 2 : A conductor carrying electric current contains same number of positive and negative charges and thus conductor is electrically neutral.

456. **STATEMENT – 1 :** The field in a moving coil galvanometers is made radial.
because
STATEMENT – 2 : The field is made radial in order to have a linear relation between current and deflection.

457. **STATEMENT – 1 :** When current through a bulb is increased by 2% power increases by 4%.

STATEMENT – 2 : Current passing through the bulb is $\propto \frac{1}{\text{Resistance}}$.

458. **STATEMENT – 1 :** When the length of a conductor is doubled; its resistance will also get doubled.

STATEMENT – 2 : Resistance is directly proportional to the length of a conductor.

459. **STATEMENT – 1 :** In the following circuit e.m.f. is 2V internal resistance of the cell is 1 Ω and R = 1 Ω the reading of the voltmeter is 1V.

STATEMENT – 2 : V = E– *i*r, where E = 2V, *i* = 1A
and R = 1 Ω

460. **STATEMENT – 1 :** The e.m.f. of the driver cell in the potentiometer experiment should be greater than the e.m.f. of the cell to be determined.

STATEMENT – 2 : The fall of potential across the potentiometer wire should not be less than e.m.f. of the cell to be determined.

461. **STATEMENT – 1 :** Direction of current can't be from negative potential.

STATEMENT – 2 : Direction of current is opposite to flow of electrons.

462. **STATEMENT – 1 :** Internal resistance of battery is drawn parallel to battery in electrical circuit.

STATEMENT – 2 : Heat generated in battery is due to internal resistance.

463. **STATEMENT – 1 :** When a cell is charged by connecting its positive electrode with positive terminal of the charger battery then potential difference across the electrodes of cell will be smaller to the EMF of cell.

STATEMENT – 2 : Potential difference across electrodes in a cell providing electric current is E – Ir where E is EMF and r internal resistance.

464. **STATEMENT – 1 :** Potential measured by a voltmeter across a wire is always less than actual potential difference across it.

STATEMENT – 2 : Finite resistance of voltmeter changes current flowing through the resistance across which potential difference is to be measured.

465. **STATEMENT – 1 :** The drift velocity of electrons in a metallic wire will decrease, if the temperature of the wire is increased.

STATEMENT – 2 : On increasing temperature, conductivity of metallic wire decreases.

466. **STATEMENT – 1**
In metre bridge experiment, a high resistance is always connected in series with a galvenometer.

STATEMENT – 2
As resistance increases, current through the circuit increases.

467. **STATEMENT – 1 :** In a simple battery circuit, the point at the lowest potential is positive terminal of the battery.

STATEMENT – 2 : The current flows towards the point of lowest potential for battery, as it does in a circuit from positive to the negative terminal.

468. **STATEMENT – 1 :** Insulators do not allow flow of current through them.

STATEMENT – 2 : Insulators have no free charge carrier.

Hint & Solution

438.	(D)	439.	(D)	440.	(D)		
441.	(B)	442.	(B)	443.	(B)	444.	Both are false.
445.	(B)	446.	(D)	447.	(B)	448.	(C)
449.	(A)	450.	(A)	451.	(D)	452.	(A)
453.	(A)	454.	(D)	455.	(D)	456.	(A)
457.	(B)	458.	(A)	459.	(A)	460.	(A)
461.	(D)	462.	(D)	463.	(D)	464.	(A)
465.	(B)	466.	(C)	467.	(D)	468.	(A)

438. Voltmeter gives terminal potential (V) thought it can give emf if internal resistance of the cell is zero.

439. $V = iR$.

440. Conceptual.

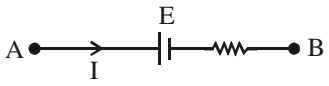
449. Charge on capacitor $q = CE\ (1-e^{-t/CR_{eq}})$

$$\therefore \quad I = \frac{dq}{dt} = \frac{E}{R_{eq}} e^{-t/CR}$$

at t = 0

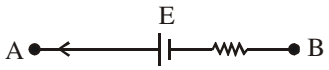
$$I = \frac{E}{R_{eq}} = \frac{E}{R+r} \Rightarrow \text{ resistance offered by capacitor is zero.}$$

450.



$V_A - E - Ir + V_B \Rightarrow V_A - V_B = E + Ir$

Similarly



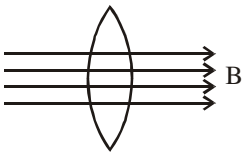
$V_A - V_B = E - Ir$.

451. emf induced across the wire

$$\varepsilon = B\ell V$$

But circuit is not complete. So no current is induced in the wire.

452.



$B = \mu_0 nI_t$

$\phi = \pi r^2 nI_t$

$$e = -\frac{d\phi}{dt} = -\pi r^2 n \frac{dI_t}{dt}$$

$r \rightarrow$ radius of solenoid.

453. When current flows through a conductor it always remains uncharged, Hence no electric field is produced outside it.

454. Power used = i^2R

Hence Power is consumed not the current.

455. The electrons are in motion which constitute electric current in a conductor but no of positive and negative charges are same.

456. $\tau = K\theta = NI\ AB \sin\theta$

If $\theta = 90°$ (i.e., field radial)

Then $\tau = (NIAB) = K\theta$.

457. $P = \Sigma^2 R$

$$100\% \times \left(\frac{dP}{P}\right) = 2\left(\frac{dI}{I}\right) 100\% .$$

458. $R = \rho\frac{\ell}{A}$

Where $\ell = 2\ell$, A = A/2
Because volume $V_1 = V_2$.

459. Here E = 2V, $I = \frac{2}{2} = 1\text{amp}$ and r = 1Ω

$\therefore$ V = E – *ir* = 2 – (1) (1) = 1 Volt

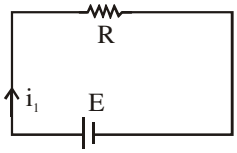
460. If either the e.m.f. of the driver cell or potential difference across whole potentiometer wire is lesser than the e.m.f. of the experimental cell, then balance point will not obtained.

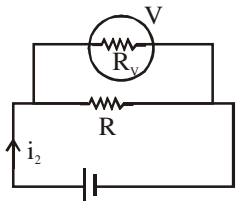
461. Direction of flow of current is from higher potential to lower potential.

462. Internal resistance is drawn in series with battery.

463. V = E + ir when charging of cell take place.

464.





$i_1 = \frac{E}{R}$

$R_{eq} = \frac{RR_V}{R + R_V}$

$i_2 = \frac{E}{(RR_V / R + R_V)}$.

465. On increasing temperature of wire the KE of electron increase and so they collide more rapidly with each other and hence their drift velocity decreases. Resistivity also increase and resistvity is inversely proportional to conductivity of material.

466. The resistance of galvanometer is fixed. In metre bridge experiments, to protect the galvanometer from a high current, high resistance is connected to the galvanometer in order to protect it from damage.

467. In a simple battery circuit the point at lowest potential is the negative terminal of battery. The current flows in the circuit from positive terminal to negative terminal.