



ASSESSMENT-1

PHYSICS-Code No. 042

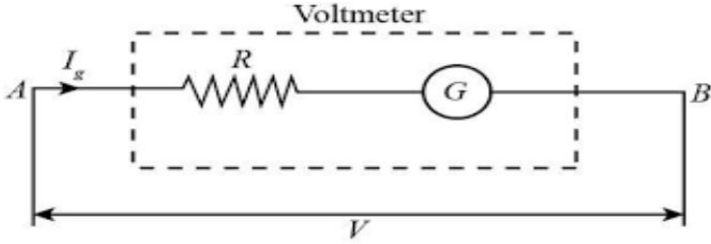
Class-XII-(2026-27)

ANSWER KEY

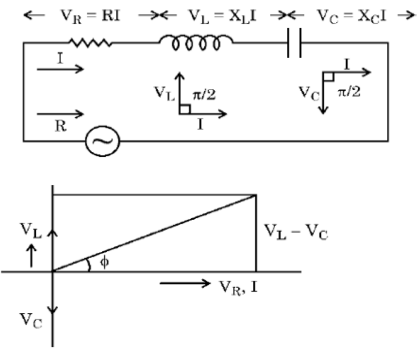
SET: 2

Q.NO	ANSWERS	MARKS
1	(B) Anti-parallel to P	1
2	(A) Its acceleration remains constant if its charge-to-mass ratio is constant. $a = \frac{qE}{m}$ For a uniform electric field , E is constant. Hence, if q/m is constant: $a = \frac{qE}{m} = \text{constant}$	1
3	(C) $6.78 \times 10^5 \text{ N m}^2/\text{C}$	1
4	(B) increase its capacitance	1
5	B) perpendicular	1
6	(B) 10 pF	1
7	(B) 1:4 $P_1 = \frac{V^2}{R}$ $P_2 = \frac{(2V)^2}{R} = \frac{4V^2}{R} = 4P_1$ $P_1 : P_2 = 1 : 4$	1
8	(C) 8V $I = \frac{\mathcal{E}}{R + r}$ $I = \frac{10}{4 + 1} = 2 \text{ A}$ $V = \mathcal{E} - Ir$ $V = 10 - (2)(1)$ $V = 8 \text{ V}$ $V = IR = (2)(4) = 8 \text{ V}$	1
9	(A) A – Metal B – Semiconductor	1
10	(C) ϵ and r/n	1

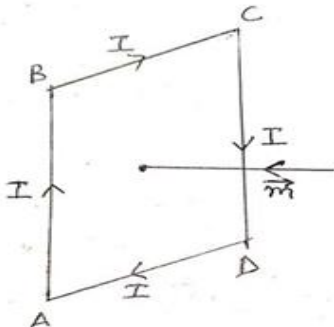
11	(B) 4×10^{-5} N/m, repulsive	1
12	(C) 0 and 0	1
13	(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
14	(C) Assertion is true reason is false.	1
15	(C) Assertion is true reason is false.	1
16	(D) Both Assertion and Reason are false.	1
	SECTION-B	
17	$P = \frac{V^2}{R}$ $R = \frac{V^2}{P} = \frac{(220)^2}{2200} = 22 \Omega$ $P' = \frac{V'^2}{R} = \frac{(110)^2}{22} = 550 W$ $H = P't$ $H = 550 \times 600$ $H = 3.3 \times 10^5 J$	$\frac{1}{2}$ $\frac{1}{2}$
17.	OR $R = \frac{V}{I} = \frac{2}{0.5} = 4 \Omega$ $\rho = \frac{RA}{L}$ $10 \text{ mm}^2 = 10 \times 10^{-6} \text{ m}^2 = 10^{-5} \text{ m}^2$ $\rho = \frac{4 \times 10^{-5}}{1}$ $\rho = 4 \times 10^{-5} \Omega \text{ m}$	$\frac{1}{2}$ $\frac{1}{2}$
18	When the separation d between the plates is increased: $C = \frac{\epsilon_0 A}{d}$ Therefore, capacitance decreases. Since the capacitor is disconnected, charge Q remains constant. $V = \frac{Q}{C}$ Hence, the potential difference increases.	$\frac{1}{2}$ $\frac{1}{2}$

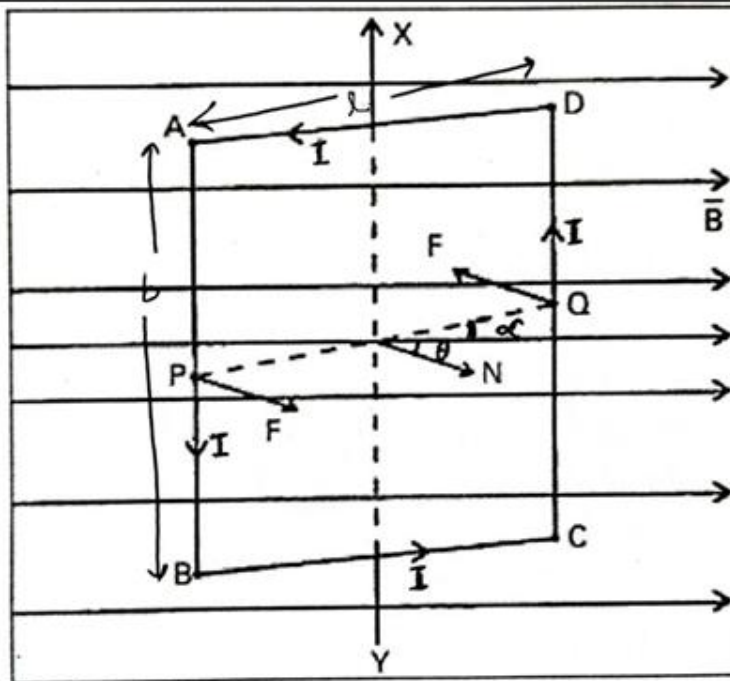
19	Bismuth is diamagnetic; diamagnetic materials are weakly repelled by a magnetic field and move towards the weaker-field region. Its relative permeability is less than 1	$\frac{1}{2}$ 1 $\frac{1}{2}$
20(I)	(a) The particle follows a helix (spiral) wound around the magnetic field lines. (b) When $\theta = 0$ When the particle enters parallel to the magnetic field, its path is a straight line with constant velocity.	1 1
OR		
20(II)	(A) The magnetic force acting on a charged particle is given by: $F = q (\mathbf{v} \times \mathbf{B})$ (B) The force is maximum when $\sin \theta = 1$, which occurs when $\theta = 90^\circ$ Condition: The charged particle moves perpendicular to the magnetic field ($\mathbf{v} \perp \mathbf{B}$) (i) Maximum force: $F_{\max} = qvB$ The force is minimum (zero) when $\sin \theta = 0$, which occurs when $\theta = 0^\circ$ or $\theta = 180^\circ$ Condition: The charged particle moves parallel or anti-parallel to the magnetic field ($\mathbf{v} \parallel \mathbf{B}$) (ii) Minimum force: $F_{\min} = 0$	1 $\frac{1}{2}$ $\frac{1}{2}$
21(I)	$\mathcal{E} = \frac{1}{2} B \omega L^2$ $\mathcal{E} = \frac{1}{2} \times 0.5 \text{ T} \times 20 \text{ rad/s} \times (1 \text{ m})^2$ $\mathcal{E} = 0.25 \times 20 \times 1$ $\mathcal{E} = 5.0 \text{ V}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
SECTION-C		
22	A galvanometer can be converted to a voltmeter by connecting a large resistance R in series with the galvanometer. 	1 $\frac{1}{2}$

	$G = 12\Omega, \quad I_g = 3mA, \quad V = 18V$ For a voltmeter, series resistance: $R = \frac{V}{I_g} - G$ $R = \frac{18}{3 \times 10^{-3}} - 12 = 6000 - 12$ $R = 5988\Omega \approx 6k\Omega$ Therefore, connect a 5988 Ω resistance in series with the galvanometer.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
23	(A) The temperature coefficient of resistivity is defined as the fractional change in resistivity per unit change in temperature. (B) Resistance and resistivity The two equations for drift velocity are: $v_d = \frac{eE\tau}{m}$ and, since $E = \frac{V}{l}$, $v_d = \frac{eV\tau}{ml}$ Current is $I = neAv_d$ Therefore, $R = \frac{V}{I} = \frac{ml}{ne^2A\tau}$ Since $R = \frac{\rho l}{A}$, $\rho = \frac{m}{ne^2\tau}$	1 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
24	(I) If the field were not normal to the equipotential surface, it would have non-zero component along the surface. To move a unit test charge against the direction of the component of the field, work would be done. This is in contradiction to the definition of equipotential surface. Alternatively $\oint \vec{E} \cdot d\vec{l} = V_A - V_B; V_A = V_B \text{ for equipotential surface}$ $\oint \vec{E} \cdot d\vec{l} = 0 \Rightarrow \cos\theta = 0 \text{ as } E \neq 0 \& dl \neq 0 \text{ and } \theta = 90^\circ$	1

	(II) When a dielectric is placed in an external electric field, due to polarization of its molecules, an electric field is induced in a direction opposite to the external field, hence net electric field inside is reduced. (III) Potential difference $(V) = \frac{Q}{C}$ $V = \frac{Qd}{A\epsilon_0}$ $V \propto d$	1 $\frac{1}{2}$ $\frac{1}{2}$
25	 $\mathcal{E} = \sqrt{I^2 [R^2 + (X_L - X_C)^2]}$ $Z = \frac{\mathcal{E}}{I}$ $Z = \sqrt{R^2 + (X_L - X_C)^2}$ (II) $I_m = \frac{V_m}{Z} \sin(\omega t - \phi)$ (III) Phase angle $\tan \phi = \frac{V_L - V_C}{V_R}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
26	(I) For series LCR circuit, the frequency at which the current amplitude is maximum. (a) Condition for resonance $X_L = X_C$ $\omega L = \frac{1}{\omega C}$ (b) (ii) (I) $Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$ $= \sqrt{(400)^2 + \left(100\pi \times \frac{5}{\pi} - \frac{1 \times \pi}{100\pi \times 50 \times 10^{-6}}\right)^2}$ $= \sqrt{160000 + 90000}$ $= \sqrt{250000}$ $= 500\Omega$ (II) $I_{rms} = \frac{V_0}{Z\sqrt{2}}$ $= \frac{140}{500 \times 1.4} = 0.2A$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

27(I)	(a) Magnetic field at centre of outer coil S_2 $B_2 = \frac{\mu_0 I_2}{2r_2}$ Flux linked with inner coil S_1 is $\phi_1 = B_2 A_1$ $= \frac{\mu_0 I_2}{2r_2} \cdot \pi r_1^2$ Also, $\phi_1 = M_{12} I_2$ $\therefore M_{12} = \frac{\mu_0}{2r_2} \cdot \pi r_1^2$ (b) $\varepsilon = -L \frac{dI}{dt}$ $L = \frac{0.4 \times 50 \times 10^{-3}}{4 \times 10^{-3}}$ $= 5 H$	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$
	OR		
27(II)	Using Faraday's law, $ e = N \frac{ \Delta \Phi }{\Delta t}$ $ e = 200 \times \frac{(4 - 1) \times 10^{-4}}{0.02}$ $ e = 3 V$ If the time taken is reduced to half, the rate of change of magnetic flux doubles. $\text{New induced emf} = 6 V$ Faraday's second law gives the magnitude of induced emf and Lenz's law gives the direction.	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{1}{2} + \frac{1}{2}$

28	(i) $\vec{m} = I\vec{A}$  Since the current is clockwise, by the right-hand thumb rule, the magnetic moment is directed into the plane of the paper.	$\frac{1}{2}$ $\frac{1}{2}$
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If the plane of the current carrying coil makes an angle α with the magnetic field

$$\vec{F}_{DA} = -\vec{F}_{BC} \text{ (cancel each other)}$$

Force on the arm DC is into the plane of the paper

$$|F_{DC}| = IbB$$

Force on the arm AB is out of the plane of the paper.

$$|F_{AB}| = IbB$$

Since forces are equal & opposite so net force = 0

Both of them form a couple and magnitude of torque acting on the coil is

τ = either force $\times$ perpendicular distance between the two forces.

$$\tau = IbB \times l \sin \theta$$

$$= IAB \sin \theta$$

$$\vec{\tau} = I\vec{A} \times \vec{B}$$

$$\vec{\tau} = \vec{m} \times \vec{B}$$

1/2

1/2

1/2

1/2

1/2

SECTION-D

29

(I) (D) $\oint \vec{E} \cdot d\vec{s} = 0$ if the charge is outside, $\oint \vec{E} \cdot d\vec{s} = \frac{q}{\epsilon_0}$ if the charge is inside.

(II) (C)

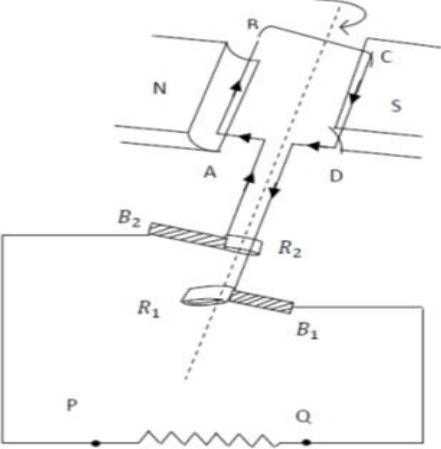
(III) (C)

1

1

1

	$\therefore \text{Electric flux through the hemisphere} = \frac{1}{2} \frac{q}{\epsilon_0}$ $= \frac{10 \times 10^{-6}}{2 \times 8.854 \times 10^{-12}} = 0.56 \times 10^6 \text{ N m}^2 \text{ C}^{-1}$ $\approx 0.6 \times 10^6 \text{ N m}^2 \text{ C}^{-1} = 6 \times 10^5 \text{ N m}^2 \text{ C}^{-1}$ (IV) (D) ϕ OR (IV) (D) Zero	1
30	(I)(B) The relative motion between the coil and the magnet produces change in magnetic flux. (II) (C) Lenz's law (III) (B) Energy (IV)(C) variable OR (IV)(C) Is repelled	1 1 1 1
	SECTION-E	
31	Definition: The mutual inductance (M) between two coils is defined as the magnetic flux linked with the second coil per unit current flowing through the first coil. Derivation For two long coaxial solenoids: - Length = ℓ - Common cross-sectional area = A - Turns = N_1, N_2 - Current in first solenoid = I Magnetic field inside the first solenoid is $B = \mu_0 \frac{N_1}{\ell} I$ Magnetic flux through each turn of the second solenoid: $\Phi = BA = \mu_0 \frac{N_1}{\ell} I A$ Total flux linkage with N_2 turns: $N_2 \Phi = \mu_0 \frac{N_1 N_2 A}{\ell} I$ Therefore, $M = \frac{N_2 \Phi}{I} = \frac{\mu_0 N_1 N_2 A}{\ell}$ Hence, the mutual inductance is $M = \frac{\mu_0 N_1 N_2 A}{\ell}$	Total-5 1 ½-diag ½ ½ ½

	(B) $N_1 = 30, \quad N_2 = 600, \quad A = 10^{-2} m^2, \quad l = 2 m, \quad \mu_r = 2000$ Mutual inductance: $M = \frac{\mu_0 \mu_r N_1 N_2 A}{l}$ $M = \frac{(4\pi \times 10^{-7})(2000)(30)(600)(10^{-2})}{2}$ $M \approx 0.226 H$	1/2 1/2 1/2 1/2
	OR	
31 (II)	(A) Principle: electromagnetic induction  <u>Working:</u> In the fig. the frame ABCD is rotating with an angular velocity ω. Due to the change in flux an emf is induced and let the direction of current is clockwise. After completing half of the rotation, the direction of current changes with the help of slip rings. This will continue and will get alternating current Initially the coil area A coincides with the magnetic field B and it is then rotated with an angular velocity 'ω' and makes an angle θ in 't' sec $\omega = \theta/t \quad \text{or} \quad \theta = \omega t$ Magnetic flux at that instant = $\phi = BA \cos \omega t$ Induced emf at that instant = $e = \frac{-d\phi}{dt} = \frac{-d(BA \cos \omega t)}{dt}$ $e = BAN \omega \sin \omega t$ when $\omega t = 90$, $\sin \omega t = 1$ and $e = e_0 = \text{max. emf}$ $e_0 = BAN \omega$ ie $e = e_0 \sin \omega t$ (B)	1/2 Diag 1/2 1/2 1/2 1/2 1/2 1/2

$$E_0 = N B A \omega$$

$$\omega = 2\pi f = 100\pi$$

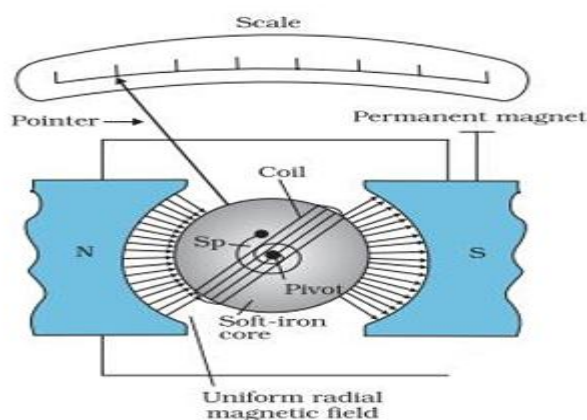
$$N = \frac{314}{(0.5)(0.02)(100\pi)}$$

 $N \approx 100$ turns

 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

32

- | | | |
|-----|---|---|
| (a) | (i) Labelled diagram | 1 |
| | Working principle of moving coil galvanometer | 1 |
| | Use of (i) Radial magnetic field | ½ |
| | (ii) Soft iron core | ½ |
| | (ii) Defining current sensitivity | 1 |
| | Reason | 1 |



Diag-1

Principle: A current carrying coil placed in uniform magnetic field, experiences a torque.

1

(i) Radial magnetic field makes the scale linear

Alternatively: Radial magnetic field provides maximum Torque.

 $\frac{1}{2}$

(ii) Use of soft iron core is to increase the strength of magnetic field/ increase sensitivity of the galvanometer.

 $\frac{1}{2}$

(ii) **Current sensitivity** is defined as deflection per unit current.

 $\frac{1}{2}$

$$I_s = \frac{\Phi}{I} = \frac{N\dot{A}B}{k}$$

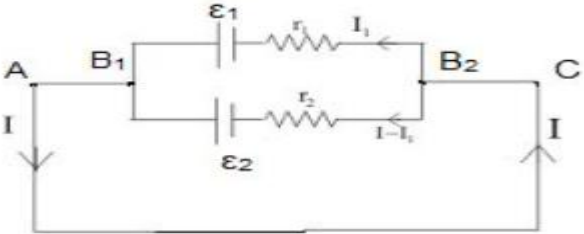
 $\frac{1}{2}$

$$\text{Voltage sensitivity } V_s = \frac{\Phi}{V} = \left(\frac{NAB}{k} \right) \frac{I}{V} = \left(\frac{NAB}{k} \right) \frac{1}{R}$$

 $\frac{1}{2}$

Increase in number of turns, increases the current sensitivity and resistance of the galvanometer in the same proportion of current sensitivity therefore Voltage sensitivity remains unchanged.

 $\frac{1}{2}$

	OR	
32	(i) (I) $\oint \vec{B} \cdot d\vec{l} = \mu_0 I_e$ I_e = Total current through the surface B = Magnetic field dl = length of small element (II) As length of solenoid increases, it appears like a long cylindrical metal sheet, so field outside approaches zero. (III) For a given perimeter, a circle encloses greater area than any other shape, which maximizes the flux. (D) $B = \frac{\mu_0 I}{2\pi r}$ $B = \frac{4\pi \times 10^{-7} \times 5}{2\pi \times 0.1}$ $B = 1 \times 10^{-5} T = 10 \mu T$	1 $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
33	 Ans. $I = I_1 + I_2$ $= \frac{E_1 - V}{r_1} + \frac{E_2 - V}{r_2}$ $I = \left(\frac{E_1}{r_1} + \frac{E_2}{r_2} \right) - V \left(\frac{1}{r_1} + \frac{1}{r_2} \right)$ $I = \frac{E_1 r_2 + E_2 r_1}{r_1 r_2} - V \left(\frac{r_1 + r_2}{r_1 r_2} \right)$ or $V = \left(\frac{E_1 r_2 + E_2 r_1}{r_1 r_2} \right) \times \left(\frac{r_1 r_2}{r_1 + r_2} \right) - I \left(\frac{r_1 r_2}{r_1 + r_2} \right)$ or $V = \left(\frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} \right) - I \left(\frac{r_1 r_2}{r_1 + r_2} \right)$ Comparing above with $V = E_{eq} - I_{eq} \times R_{eq}$ We get $E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$	1- diagram $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$

	$\begin{aligned} \text{E.M.F., } E &= \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} \\ &= \frac{(1.5 \times 0.3) + (2 \times 0.2)}{0.2 + 0.3} \end{aligned}$ $\begin{aligned} &= \frac{0.45 + 0.4}{0.5} \\ &= 1.7 \text{ V} \end{aligned}$ Internal Resistance, $\begin{aligned} r &= \frac{r_1 r_2}{r_1 + r_2} \\ &= \frac{0.2 \times 0.3}{0.2 + 0.3} = \frac{0.06}{0.5} \\ &= 0.12 \, \Omega \end{aligned}$	½ ½ ½ ½
	OR	

1. Kirchhoff's Current Law (KCL):

At any junction in an electrical circuit, the **algebraic sum of currents is zero**.

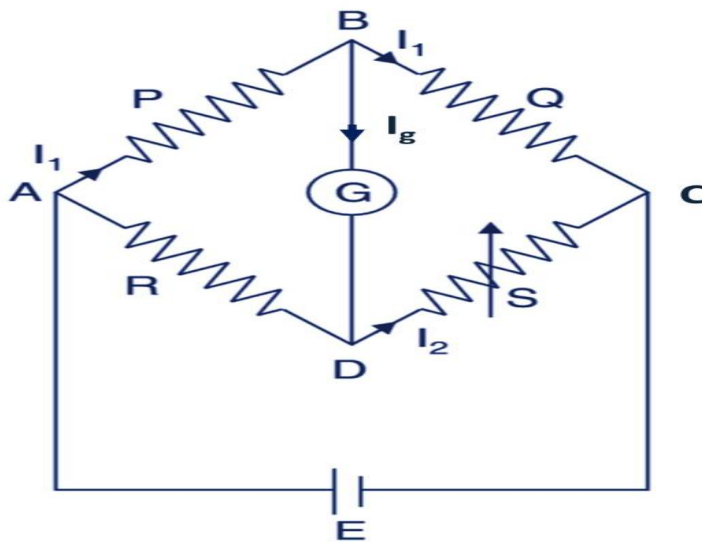
$$\sum I = 0$$

i.e., **sum of currents entering a junction = sum of currents leaving the junction**.

2. Kirchhoff's Voltage Law (KVL):

In any closed loop of an electrical circuit, the **algebraic sum of potential differences is zero**.

$$\sum V = 0$$



At balance, **no current flows through the galvanometer**:

$$I_g = 0$$

Applying Kirchhoff's voltage law to the two loops,

$$I_1 P = I_2 R$$

and

$$I_1 Q = I_2 S$$

Dividing,

$$\frac{P}{Q} = \frac{R}{S}$$

Therefore, the **condition for balance of a Wheatstone bridge**

$$\frac{P}{Q} = \frac{R}{S}$$

	(B) Using Kirchhoff's Loop Rule At junction A: $I_1 = I_2 + I_3 \quad (1)$ Upper loop $ABCD$: $-10 - 3I_2 - 2I_1 + 12 = 0$ $\boxed{2I_1 + 3I_2 = 2} \quad (2)$ Lower loop $ADEFA$: $-10 - 3I_2 + 4I_3 = 0$ $\boxed{3I_2 - 4I_3 = -10} \quad (3)$ Solving (1), (2) and (3): $\boxed{I_1 = 1.69 \text{ A}}$ $\boxed{I_2 = -0.46 \text{ A}}$ $\boxed{I_3 = 2.15 \text{ A}}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
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