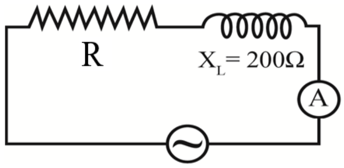
Ministry Exams

Chapters(1 TO 8)

Trial Ministry Exam (1)

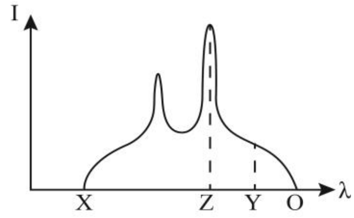
Read the questions carefully then answer according the instructions given in each question:

1. **Choose to answer (A) or (B): Write down the scientific concept that expresses:**
   A. The self-inductance of a coil that generates an induced electromotive force of 1 volt when the current intensity through it changes at a rate of 1 Ampere/sec.
   B. The intensity of the direct current that generates the same power in a resistance as that generated by the considered alternating current.
2. **Choose to answer (A) or (B): Mention ONE use of:**
   A. Thermal imaging. B. The electron microscope.
3. **Choose to answer (A) or (B): What is meant by:**
   A. The electromotive force of a source 1.5 Volt?
   B. The quantity of charge that passes through a given cross-section of a conductor in one second is 10 Coulombs?
4. **Choose the correct answer:** One characteristic of the magnetic flux produced by an electric current passing through a solenoid:
   (A) In the form of uniform concentric circles. (B) Similar to the flux of a bar magnet.
   (C) Similar to the flux of a short magnet.
   (D) Its direction is determined by Fleming's right hand rule.
5. **Give reason for:** An electric bulb connected in the secondary circuit of a transformer does not operate if the primary coil is connected to a battery.
6. **Give reason for:**
   Dark lines are found in the solar spectrum when analyzed by a spectrometer.
7. In the circuit of a transistor as a switch, the electromotive force of the battery in the collector circuit (V_{cc}) = 10 V, and the collector circuit resistance (R_c) = 98 Ω. If the potential difference between the collector and the emitter = 0.2 V, **calculate** the intensity of the collector current.
8. **What happens to** the reading of the hot - ammeter in the circuit shown in figure when the coil is replaced by a resistance wire of 200 Ω? **Explain** the reason.



9. A straight wire 25 cm long is placed perpendicular to uniform magnetic flux of density 0.5 T. If the wire in moved in the flux area at unifrom velocity 0.3 m/s and the motion direction subtends an angle 30° to the flux direction, **calculate** the induced electromotive force in the wire.
10. **Choose to answer (A) or (B): Write down mathematical relation that expresses:**
    A. The torque acting on a coil carrying an electric current whose plane is parallel to the direction of magnetic flux.
    B. The value of the shunt resistance in the ammeter.
11. **Choose the correct answer:**
    An electron moves at velocity (ν) under the effect of potential difference (V). If the potential difference applied to the electron is increased to (2V), the electron velocity increases to:
    (A) 2ν (B) $\sqrt{2}\nu$ (C) 4ν (D) $\frac{1}{2}\nu$
12. **Choose to answer (A) or (B):**
    A. **State** Lenz's rule. B. **Define** the frequency of the alternating current.

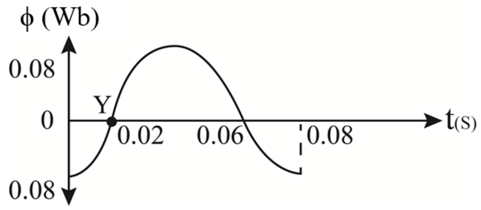
13. The graph represents X-rays spectrum produced by Coolidge tube. **Which** wavelength of those labels (X, Z, Y or O) decreases by increasing the atomic number of the target element?



14. **Give reason for:**
Selecting Helium and Neon elements in LASER device.

15. **Choose to answer (A) or (B): Mention ONE application of:**
A. Self-induction in a coil. B. Mutual induction between two coils.

16. The graph represents the change in the magnetic flux through the dynamo coil during rotation in a uniform magnetic field. If the coil has cross-sectional area 0.12 m^2 and 10 turns, **calculate** the induced emf at the instant (Y). (Consider: $\pi = 3.14$).



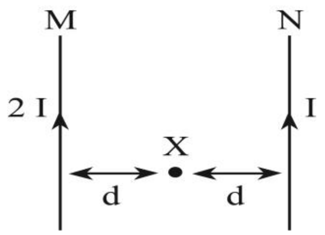
17. **What is meant by:** Coherency of laser photons? **What** application you studied depends on this characteristic of laser?

18. If the diameter of a metal wire is increased to four times its value, at constant length and temperature, **state what** would happen to each of its electric resistance and resistivity.

19. **Choose to answer (A) or (B): Mention the scientific idea of operation of:**
A. The hot wire ammeter in measuring the alternating current.
B. The resonant circuit in receiving a particular wireless wave.

20. **Choose to answer (A) or (B): Mention the name of the device that:**
A. Converts the mechanical energy into electrical energy.
B. Converts the electrical energy into mechanical energy.

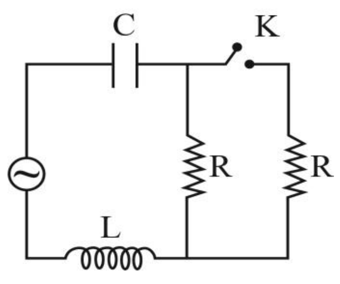
21. **Choose to answer (A) or (B):**
A. The diagram shows two long parallel wires (M and N) through which electric currents (2I and I) pass respectively. **What** change should be done to the position of the wire (M) in order to make the magnetic flux density at the point (X) vanish?



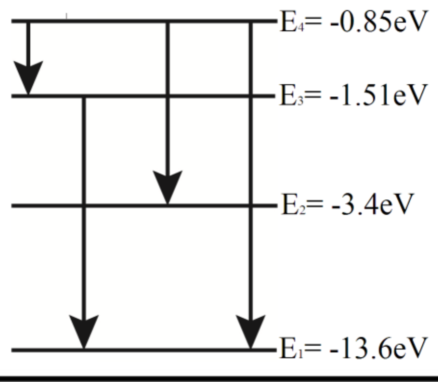
B. A circular coil is connected to a battery of negligible internal resistance. If a half of the coil turns is removed away and the remainder half is reconnected to the same battery, **what** change has happened to the density of magnetic flux at its center?

22. **How** did Max Planck explain the decrease in the intensity of the blackbody radiation as the frequency exceeds a certain limit?

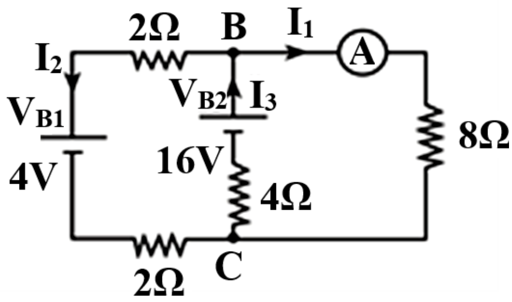
23. The AC circuit shown in the diagram is in a state of resonance. **Would** the circuit be kept at resonance when the switch (K) is turned on? **And why**?



24. The diagram shows a number of electron transitions in the hydrogen atom. **Calculate** the energy of the photon emitted in the visible region.

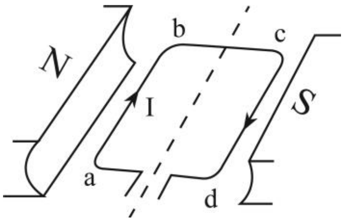


25. In the given electric circuit, **find** the ammeter reading (A), neglecting the internal resistance of the batteries (V_{B1}, V_{B2}).



26. **Explain:** The reason of the diffusion current through the pn junction.

27. The diagram shows a simple electric motor:
First: Name the rule that can be used to determine the magnetic flux direction due to the flowing of current through the side (ab).
Second: Determine the direction of the coil rotation.

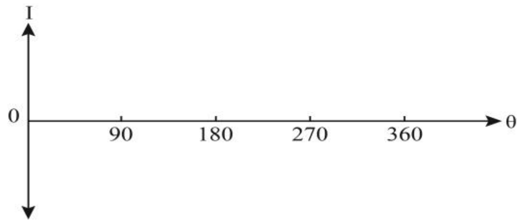


28. **<u>Choose to answer (A) or (B): What is the reason of:</u>**
A. The temperature rise of the iron core in the electric transformer during operation?
B. Continuity of the motor coil rotation in one direction?

29. **<u>Choose to answer (A) or (B): Give reason for:</u>**
A. The frequency of gamma-rays photon decreases on colliding with a free electron in Compton Effect.
B. The dominant color of light emitted from an incandescent lamp differs than that emitted by burning charcoal.

30. Three identical capacitors, each of capacitance 20 μf, are connected together in parallel then to an AC supply of frequency 50 Hz. **Find** their total capacitive reactance. Given that: ($\pi = 22/7$)

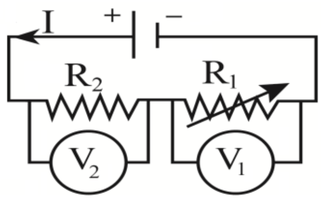
31. In an AC dynamo, the two metal rings at the coil terminals are replaced by a commutator. **Plot** a curve to represent the generated current in this case.



32. **<u>Choose the correct answer:</u>**
The objective lens of the telescope in the spectrometer:
(A) Analyzes the spectrum into its components
(B) Receives spectrum directly from its source.
(C) Focuses spectrum onto the triangular prism.
(D) Focuses the rays belonging to the same color at a focal point.

33. **<u>Choose to answer (A) or (B): Write down the scientific concept expressed as:</u>**
A. Emission due to the relaxation of an atom from the excited state to a lower state after the lifetime interval is over.
B. Light amplification by stimulated emission of radiation.

34. In the given electric circuit, **what** would happen to the reading of both voltmeters (V_1) and (V_2) when increasing the value of the variable resistance (R_1)?



35. A series AC circuit consists of an inductive coil of ohmic resistance 1000Ω and inductive reactance 2000Ω is connected to a capacitor of capacitive reactance 1000Ω and an AC supply of frequency 500/π Hz. **Calculate** the impedance of the circuit.

36. An ohmmeter has resistance (R). The pointer deflects to its zero scale as a current of 400μA passes through its circuit. A resistance (R_x) is connected externally to the ohmmeter terminals and makes the pointer deflect to 1/8 of the current scale. **Find** the ratio: (R/R_x).

37. **Choose to answer (A) or (B): Compare between:**
   A. Inductive reactance of a coil and capacitive reactance of a capacitor (with respect to effect of increasing the current frequency to double).
   B. A circuit consisting of an AC supply and an inductive coil of negligible ohmic resistance and a circuit consisting of an AC supply and a capacitor (with respect to the phase difference between the voltage and the current).

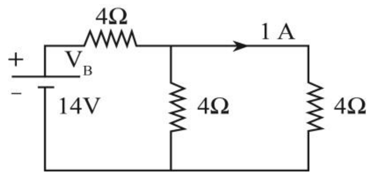
38. **Choose the correct answer:**
   A galvanometer of coil resistance (R_g) is connected to a multiplier of resistance ($2R_g$) to be converted into a voltmeter of a measuring range (V_1). If this galvanometer is connected to a multiplier of resistance ($5R_g$), the measuring range of the new voltmeter becomes:
   (A) $3V_1$ (B) $2.5V_1$ (C) $2V_1$ (D) $0.4V_1$

39. **Choose the correct answer:** In Faraday's Experiment for electro-magnetic induction, the induced emf in the coil increases when:
   (A) Keeping the magnet still inside the coil.
   (B) Speeding up the magnet motion relative to the coil.
   (C) Connecting a galvanometer to the coil (D) Increasing the spacing between the coils turns.

40. A monochromatic light of frequency 6×10^{14} Hz is incident onto a metal surface of threshold (critical) frequency 7×10^{14} Hz. **What** is the effect of increasing the intensity of this light on the possibility of releasing electrons out of the surface?

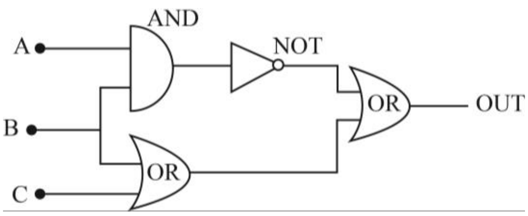
41. **Choose the correct answer:** If the permanent magnet in the galvanometer had flat poles, the magnetic flux in the region in which the coil rotates would be:
   (A) Of different densities according to the angle of coil position. (B) Radial lines.
   (C) Always perpendicular to the coil plane. (D) Always parallel to the coil plane.

42. **Choose the correct answer:**
   In the given circuit, the internal resistance of the battery equals:
   (A) 0.5Ω (B) 1Ω (C) 2Ω (D) 4Ω



43. **Choose to answer (A) or (B):**
   A. **Compare between**: Pure silicon crystal and n-type crystal (with respect to ratio between the concentration of positive holes and free electrons).
   B. The diagram shows a connection of some logic gates: **Write down** the output value when the input values are identical.

A	B	C	OUT



44. **When** does the induced electromotive force between the terminals of a straight wire, moving in magnetic flux vanish? **Explain** your answer.

45. Two long parallel wires, through each an equal current (I) passes, and have a normal distance between them (d). The table below records the mutual magnetic force per unit length (F) of the wire and the reciprocal of the normal distance between them (1/d).
   ($\mu = 4\pi\times10^{-7}$ Wb/A.m)

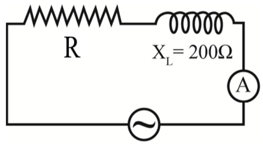
F (N/m)	0.8×10^{-5}	1.6×10^{-5}	2×10^{-5}	4×10^{-5}	8×10^{-5}
1/d (m^{-1})	10	20	25	50	100

   1) **Draw** a graphical relation between (F) on Y-axis and (1/d) on X-axis.
   2) From the graph **find**: The current intensity (I) passing through each wire.

Model Trial Ministry Exam (1)

1. **Choose to answer (A) or (B): Write down the scientific concept that expresses:**
   A. The Henry. B. The effective value of alternating current.
2. **Choose to answer (A) or (B): Mention ONE use of:**
   A.- Scientists analyze images to determine possible natural resources
   - Military purpose - Medicine - Criminology.

   B. It is an important lab instrument used to detect diminutive particles (very small particles).
3. **Choose to answer (A) or (B): What is meant by?**
   A. The total work done to transfer unit charge throughout the circuit outside and inside the source equals 1.5 Joule.
   OR The voltage difference across the source when the current ceases (I = 0) to flow in the circuit equals 1.5 Volt.
   B. The electric current intensity equals 10A.
4. **Choose the correct answer:** **(B) Similar to the flux of a bar magnet.**
5. **Give reason for:** Because the battery generated direct emf generates a magnetic field of constant value and direction ($\Delta\varphi/\Delta t$) = 0, so no induced emf is generated.
6. **Give reason for:** These lines represent the absorption spectrum of the elements in the sun atmosphere basically helium and hydrogen gases.
7. $V_{CC} = V_{CE} + I_C R_C$ $\quad 10 = 0.2 + 98 I_C$ $\quad I_C = 0.1A$
8. Before replacing the coil by a resistance:



$$I = \frac{V}{Z} \qquad \because Z = \sqrt{R^2 + X_L^2} \qquad \therefore I = \frac{V}{\sqrt{R^2 + X_L^2}} \qquad I = \frac{V}{\sqrt{R^2 + 200^2}}$$

After replacing the coil by the resistance of 200Ω:

$$I = V / R_{eq} \qquad \because R_{eq} = R + 200 \qquad \therefore I = V/(R + 200)$$

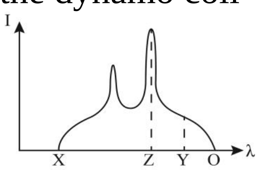
$\because$ The algebraic sum is greater than the vectors sum, so (R + 200) $> \sqrt{R^2 + 200^2}$

$\therefore$ The current intensity decreases and the reading of the hot wire ammeter decreases.

9. $EMF_{wire} = BLv\sin\theta$ $\quad EMF_{wire} = 0.5 \times 25 \times 10^{-2} \times 0.3 \times \sin 30$ $\quad EMF_{wire} = 0.01875\,Volt$
10. **Choose to answer (A) or (B): Write down mathematical relation that expresses:**
    A. $\tau = BIAN$ B. $R_S = I_g R_g / (I - I_g)$
11. **Choose the correct answer:**

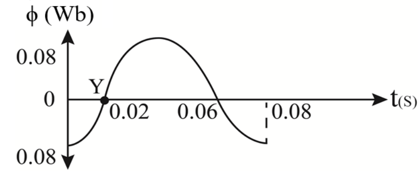
(B) $\sqrt{2}\nu$ Where: $eV = \frac{1}{2} m_e \nu^2$ $\quad \frac{V_1}{V_2} = \left(\frac{\nu_1^2}{\nu_2^2}\right)$ $\quad \frac{V}{2V} = \left(\frac{\nu_1^2}{\nu_2^2}\right)$ $\quad \nu_2 = \sqrt{2}\nu_1$

12. **Choose to answer (A) or (B):**
    A. The induced current must be in a direction such as to oppose the change producing it.
    B. It is the number of complete cycles made by the AC current in one second.
    OR It is exactly the same as the number of complete revolutions made by the dynamo coil in one second.
13. **Z** (Hard Radiation)



14. **Give reason for:** These two elements have been selected due to the near equality of the values of the same metastable excited energy levels in these two elements.
15. **Choose to answer (A) or (B): Mention ONE application of:**
    A. Fluorescent lamp. B. Transformer.

16. Where: $f = 1/T = 1/0.08 = 12.5Hz$ and $\varphi = BA$



$emf_{inst} = BA\omega NSin\theta = \varphi(2\pi f)NSin(360ft)$

$emf_{inst} = 0.08 \times (2 \times 3.14 \times 12.5) \times 10 \times Sin(360 \times 12.5 \times 0.02)$

$emf_{inst} = 62.8 \times Sin(90)$ $\qquad emf_{inst} = 62.8V$

OR At (t = 0.02) ($\phi = 0$) so ($emf_{inst} = emf_{max}$)

$emf_{max} = BA\omega N = \varphi(2\pi f)N$ $\qquad emf_{max} = 0.08 \times (2 \times 3.14 \times 12.5) \times 10 = 62.8V$

17. **What is meant by?**

Coherency of laser photons:

They come out together at the same time sequence and maintains same phase difference during propagation over long distances. This makes radiation intensed and focused.

Applications: - Arts and laser shows - Holography

18. $D_2 = 4D_1$ $\quad \frac{R_1}{R_2} = \frac{\rho_{e1}}{\rho_{e2}} \times \frac{L_1}{L_2} \times \left(\frac{D_2}{D_1}\right)^2$ $\quad \frac{R_1}{R_2} = 1 \times 1 \times \frac{(4D_1)^2}{(D_1)^2}$ $\quad R_2 = \frac{1}{16}R_1$ (**R Decrease 16times**)

The resistivity **remains constant** as it depends on the type of material and temperature.

19. **Choose to answer (A) or (B): Mention the scientific idea of operation of:**

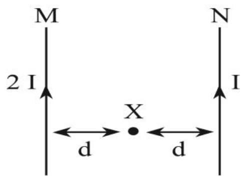
A. It depends on the thermal effect of the current (AC OR DC).

B. Power supply frequency equals to the oscillating circuit frequency ($f_{station} = f_{oscillator}$).

20. **Choose to answer (A) or (B): Mention the name of the device that:**

A. The generator (dynamo) $\qquad$ B. The electric motor.

21. **Choose to answer (A) or (B):**



A. $B_1 = B_2$ $\qquad \frac{I_1}{d_1} = \frac{I_2}{d_2}$ $\qquad \frac{2I}{d_1} = \frac{I}{d}$ $\qquad \therefore d_1 = 2d$

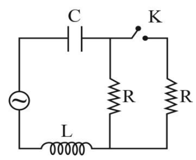
(So move the wire (M) to the left distance (d) to make the distance from (X) is 2d)

B. $N \alpha L \alpha R \alpha \frac{1}{I}$ $\qquad N_2 = \frac{1}{2}N_1$ $\qquad \frac{N_2}{N_1} = \frac{I_1}{I_2} = \frac{1}{2}$ $\qquad \because B = \frac{\mu NI}{2r}$ $\qquad \frac{B_1}{B_2} = \frac{N_1}{N_2} \times \frac{I_1}{I_2} \times \frac{r_2}{r_1}$

$\frac{B_1}{B_2} = 2 \times \frac{1}{2} \times 1 = 1$ $\qquad$ The magnetic flux at the center of the coil **remains constant**.

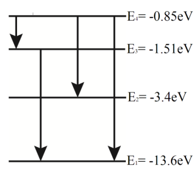
22. **Give reason for:** As ($P_W = \phi_L E$) when the (P_W) is constant, (ϕ_L) is the intensity and ($E = h\upsilon$) so ($\phi_L \, \alpha \, 1/\upsilon$) so when the frquency increased, the intensity decreased.

23. **Yes** it will be kept at resonance when the switch (K) is turned on.



Because the resonance will change if the frequency is changed and (L, C) changed. So when the key is turned on the AC source unchanged so the frequency remains constant and the value of (L) and (C) not changed.

24. The transition from level (4) to level (2) lies in the visible region:



$E_{Photon} = E_4 - E_2$ $\qquad E_{Photon} = -0.85 - (-3.4)$ $\qquad E_{Photon} = 2.55eV$

$E_{Photon} = 2.55 \times 1.6 \times 10^{-19}$ $\qquad E_{Photon} = 4.08 \times 10^{-19} J$

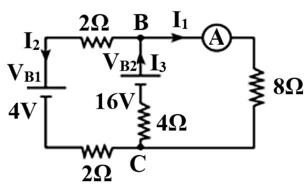
25. Using KCL at point (B): $\quad I_1 + I_2 = I_3$ $\quad 1I_1 + 1I_2 - 1I_3 = 0 \to (1)$

Using KVL at right loop: $\quad 8I_1 + 4I_3 - 16 = 0$ $\quad 8I_1 + 0I_2 + 4I_3 = 16 \to (2)$

Using KVL at left loop: $\quad 4I_3 - 16 + 2I_2 + 4 + 2I_2 = 0$ $\quad 0I_1 + 4I_2 + 4I_3 = 12 \to (3)$

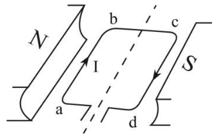
By solving the three equations $I_1 = 1A$ $\quad I_2 = 1A$ $\quad I_3 = 2A$

The reading of ammeter equals 1A.



26. As some holes diffuse from the p-type region (high concentration of holes) to the n-type region (low concentration of holes). Also, some electrons diffuse from from the n-type region (high concentration of electrons) to p-type region (low concentration of electrons).

27. **Frist:** The Ampere's right hand rule **Second:** Anti-clockwise

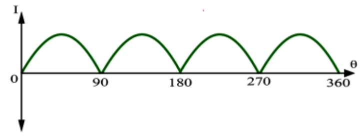


28. **Choose to answer (A) or (B): What is the reason of?**
   A. Due to eddy currents in iron core.
   B. Due to the existence of cylinder split into two halves (commutator), which changes its position each cycle.

29. **Choose to answer (A) or (B): Give reason for:**
   A. Because when the gamma-rays photon collided with a free electron the energy of photon decreases so its frequency decreases.
   B. Due to Wien's law ($\lambda_{max} \alpha 1/\text{Temperature}$), an incandescent lamp differs than the burning charcoal, so the color of light (wavelength) emitted from an incandescent lamp differs than that emitted by burning charcoal.

30. $C_{eq} = nC$ $\quad C_{eq} = 3\times 20$ $\quad C_{eq} = 60\mu f$
   $X_{C_T} = 1/2\pi f C_{eq}$ $\quad X_{C_T} = 1/(2\times(22/7)\times 50\times 60\times 10^{-6})$ $\quad X_{C_T} = 53.03\Omega$

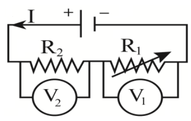
31.



32. **Choose the correct answer:**
   (D) Focuses the rays belonging to the same color at a focal point.

33. **Choose to answer (A) or (B): Write down the scientific concept expressed as:**
   A. The Spontaneous emission. B. Laser

34. $R_{eq} \alpha 1/I_T$, when the (R_1) increases, the (R_{eq}) increases and the total current decreases. $\because V_1 \uparrow = \downarrow IR_1 \uparrow\uparrow$, so the reading of voltmeter (V_1) will **increase** and $V_2 \downarrow = \downarrow IR_{2\,(Constant)}$, so the reading of voltmeter (V_2) will **decrease**.



35. $Z = \sqrt{R_L^2 + (X_L - X_C)^2}$ $\quad Z = \sqrt{(1000)^2 + (2000-1000)^2}$ $\quad Z = 1414.2\Omega$

36. $I_{max} = 400\times 10^{-6} A$ $\quad I = (1/n)I_{max}$ $\quad I = (1/8)\times I_{max}$ $\quad \therefore n = 8$
   $R_X = (n-1)R_d$ $\quad \therefore R_X = 7R_d$ $\quad R_d / R_X = 1/7$ $\quad \therefore R/R_X = 1/7$

OR $I_{max} = V_B / R_d$ $\quad I = V_B /(R_d + R_X)$ $\quad I_{max}/I = (R_d + R_X)/R_d$ $\quad 8 = (R_d + R_X)/R_d$
   $8R_d = (R_d + R_X)$ $\quad 7R_d = R_X$ $\quad R_d / R_X = 1/7$ $\quad \therefore R/R_X = 1/7$

37. **Choose to answer (A) or (B): Compare between:**

No	Point of comparison	Inductive reactance of a coil	capacitive reactance of a capacitor
A.	**Effect of increasing the current frequency to double**	Increase to double ($X_L \alpha f$)	decrease to half ($X_C \alpha \frac{1}{f}$)

No	Point of comparison	A circuit consisting of an AC supply and an inductive coil of negligible ohmic resistance	A circuit consisting of an AC supply and a capacitor
B.	**phase difference between the voltage and the current**	The voltage leads the current by angle 90°	The current leads the voltage by angle 90°

38. **Choose the correct answer:**

(C) $2V_1$ Where: $R_m = \frac{V - V_g}{I_g}$ $2R_g = \frac{V_1 - V_g}{I_g}$

$2R_g I_g = V_1 - V_g$ $2V_g + V_g = V_1$ $V_1 = 3V_g$

$R_m = \frac{V - V_g}{I_g}$ $5R_g = \frac{V - V_g}{I_g}$ $5R_g I_g = V - V_g$ $5V_g + V_g = V$ $V = 6V_g = 2V_1$

39. **Choose the correct answer:**

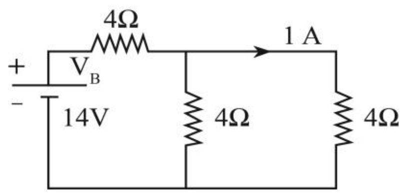
(B) speeding up the magnet motion relative to the coil.

40. No effect (no electrons released). Where ($\upsilon < \upsilon_C$).

41. **Choose the correct answer:**

(A) of different densities according to the angle of coil position.

42. **Choose the correct answer:**



(B) 1Ω Where: $I_T = 1 + 1 = 2A$ and $R_{eq} = \frac{4}{2} + 4 = 6\Omega$

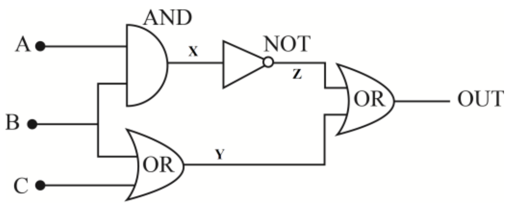
$V_B = (R_{eq} + r)$ $14 = 2 \times (6 + r)$ $\therefore r = 1\Omega$

43. **Choose to answer (A) or (B):**

No	Point of comparison	Pure silicon crystal	n-type crystal
A.	ratio between the concentration of positive holes and free electrons	$\frac{p}{n} = 1$ The concentration of positive holes equals free electrons	$\frac{p}{n} < 1$ The concentration of positive holes smaller than free electrons

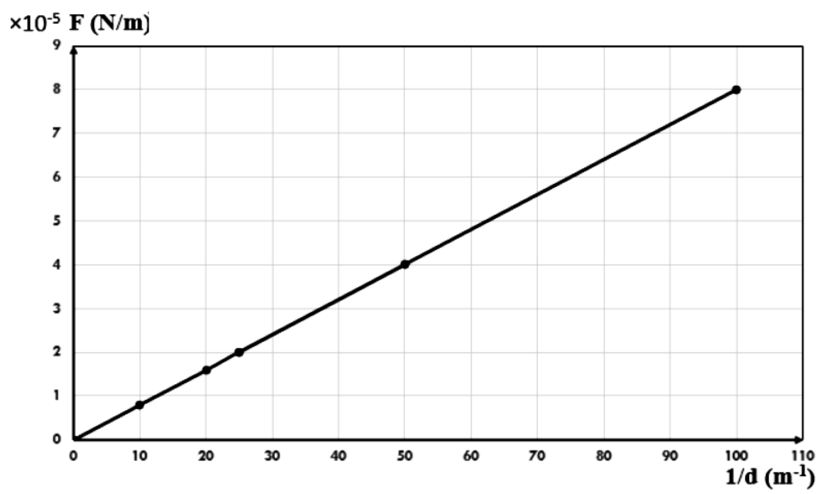
B.

A	B	C	X	Y	Z	OUT
0	0	0	0	0	1	1
1	1	1	1	1	0	1



44. When the straight wire is moving parallel to the magnetic field.
Because $emf = -BLv\sin\theta$ and $\theta = 0^o$, so emf = 0.

45. 1) Drawing.



2) $Slope = \frac{\Delta Y}{\Delta X} = \frac{F}{1/d} = Fd$

$Slope = \frac{(1.6 - 0.8) \times 10^{-5}}{(20 - 10)}$

$Slope = 8 \times 10^{-7}$

$F = \frac{\mu I_1 I_2 L}{2\pi d}$ $F = \frac{4\pi \times 10^{-7} \times I^2 L}{2\pi d}$

$\frac{Fd}{L} = 2 \times 10^{-7} \times I^2$

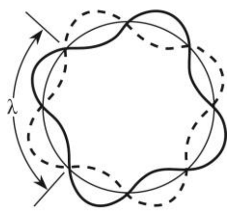
$Slope = 2 \times 10^{-7} \times I^2$

$8 \times 10^{-7} = 2 \times 10^{-7} \times I^2$ $I = 2A$ The current in each wire is 2A

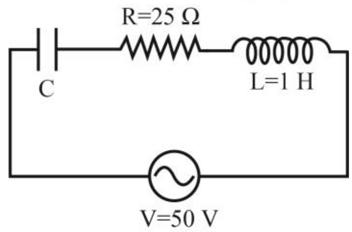
Trial Ministry Exam (2)

Read the questions carefully then answer according the instructions given in each question:

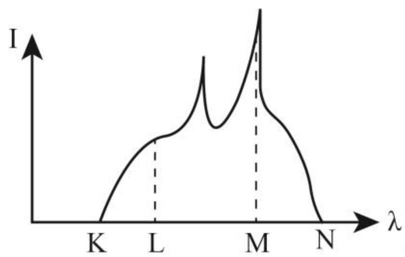
1. **Choose to answer (A) or (B): What is meant by?**
   A. Faraday's law for electromagnetic induction. B. Lenz's rule.
2. **Choose to answer (A) or (B): Mention ONE role of:**
   A. The cathode in the photoelectric cell.
   B. The electric or magnetic fields in the cathode ray tube.
3. **Choose to answer (A) or (B): Write down the scientific concept:**
   A. The total work done to transfer a quantity of charge of 1 Coulomb inside and outside the battery.
   B. The reciprocal of the material resistivity.
4. **Mention ONE use for:** Fleming's left hand rule.
5. **Give reason for:**
   The coils of the electric transformer are made up of metallic wires having as low ohmic resistance as possible.
6. **Choose the correct answer:**
   An electron moves in an energy shell (n = 4) around the nucleus of the hydrogen atom and accompanied by a standing wave of length (λ).
   The radius of the shell is given by:
   (A) $4\lambda/\pi$ (B) $2\lambda/\pi$ (C) λ/π (D) $\lambda/2\pi$



7. In the electric circuit shown in figure, the value of current is 2A.
   First: Is the circuit in a state of resonance?
   Second: Calculate the capacitance of the capacitor (C).
   (Given that: $\pi = 22/7$)



8. **Choose the correct answer:**
   Two capacitors have capacitance (C_1 and C_2) where ($C_1 = 2C_2$). They are connected together in series to an AC supply. In this case, the charge on the plates of the capacitor (C_1) is .... that on the plates of the capacitor (C_2).
   (A) double (B) equal to (C) a half of (D) a quarter of
9. The coil of an AC dynamo generates an emf of maximum value 100V when it rotates in a magnetic field at frequency 50Hz. **Calculate** the instantaneous emf after 2.5×10^{-3} s from the position of being perpendicular to the magnetic flux lines.
10. **Choose to answer (A) or (B): Mention ONE function of:**
    A. The variable resistor in the ohmmeter. B. The spiral springs in the galvanometer.
11. The power of a laser beam is 30 Watt, and the energy of a photon is 3×10^{-19}J. **Calculate** the rate of emission of laser photons (in one second).
12. **Mention ONE factor that affects:**
    The effective emf that is generated in the dynamo coil.
13. The graph represents X-rays spectrum produced from Coolidge tube. **Which** wavelength (K, L, M, or N) can be determined by the relation: $\lambda = hc/\Delta E$
    Where (ΔE) is the energy difference between two levels in the target atom.



14. **Choose the correct answer:**
In the He-Ne laser, the neon atoms are excited by means of:
(A) Electric discharge (B) Optical pumping
(C) Chemical energy (D) Collision with excited helium atoms.

15. **Choose the correct answer:**
A coil of 500 turns is placed normally to a magnetic field. If the magnetic flux through the coil changes at a rate of 0.01 Wb/s, the emf induced in the coil equals:
(A) 5V (B) 0.7V (C) 0.5V (D) Zero

16. **Choose to answer (A) or (B):**
A. **Compare** between (OR) Gate having two inputs and (AND) Gate having two inputs (with respect to number of cases to give (0) output).
B. There are a number of different electrical charges in n-type crystal. Some of them are negatively charged while others are positive.
First: Define these charges.
Second: Write down the mathematical expression that relates the concentration of these charges to each other in the crystal.

17. Each diagram (X and Z) shows an atom of the active medium that produces laser.

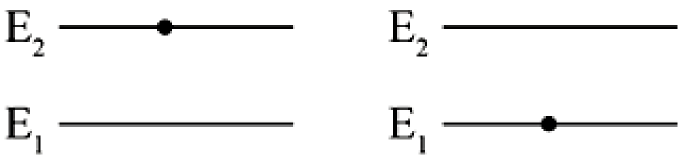


Diagram (Z) Diagram (X)

What would happen if a photon of energy $= (E_2 - E_1)$ falls on each of them?

18. Three identical resistances are connected together, once in series and another in parallel, then to the same battery. **Find** the ratio between the current intensity through the battery in both cases. (Neglecting the internal resistance of the battery).

19. **Choose to answer (A) or (B): Write down the mathematical relation used to calculate:**
A. The capacitive reactance of a capacitor.
B. The impedance of an AC circuit consisting of a resistance and an inductive coil.

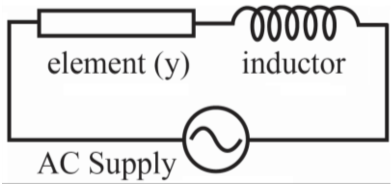
20. **Choose to answer (A) or (B): Mention ONE application of:**
A. Mutual induction between two coils.
B. Eddy currents.

21. **Choose to answer (A) or (B):**
A. Two parallel long straight wires, each of them carries an equal current (I). The distance between the two wires is increased to double. In order to maintain the magnitude of the mutual force between them as its original value, the current intensity through each wire should be modified to be:
(A) $I/\sqrt{2}$ (B) $I\sqrt{2}$
(C) 2I (D) 4I
B. **Compare** between the hot-wire ammeter and sensitive galvanometer (with respect to the reason that makes the pointer settle at a definite reading on its scale).

22. If the wavelength having maximum intensity in the solar radiation is 0.5 μm. **Calculate** the wavelength having maximum intensity in the radiation emitted by Earth, given that the surface temperatures of the Sun and Earth are 6000 K and 300 K respectively.

23. **<u>Choose the correct answer:</u>**

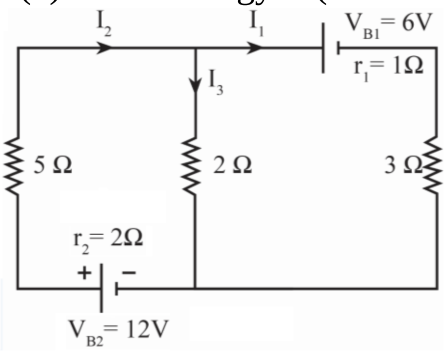
An inductive coil of negligible resistance is connected to an unknown element (y) and an AC supply as shown. The total potential difference = The potential difference between the coil terminals + The potential difference between the terminals of (y). This element is:



(A) an ohmic resistance. (B) an inductive coil of negligible resistance.
(C) a capacitor. (D) an inductive coil of ohmic resistance.

24. In the hydrogen atom, **what** is the order of an energy level (n) whose energy is (-1.51 eV)?

25. In the given circuit, **find** the value of (I_1) using Kirchhoff's laws.



26. **What** is meant by the electrical noise?
What is its effect on the information-bearing signals in analog radio receivers?

27. **Prove** that the multiplier resistance (R_m) required to convert the galvanometer into a voltmeter is given by the relation: [$R_m = (V - V_g)/I_g$] (Accompanied with a drawing).

28. **<u>Choose to answer (A) or (B): What happens when?</u>**

A. Transferring the electrical power from the generating power station to zones of distribution without using a step-up transformer at the power station.

B. The motor coil rotates from the position being parallel to the magnetic flux till it reaches the perpendicular position to flux lines.

29. **Compare** between the electron and the photon (with respect to the electric charge).

30. **Plot** a graph that represents the change in each of the current (I) and the voltage (V) versus time during a complete cycle in an AC circuit consisting of an ohmic resistance and AC supply.

31. **<u>Write down the scientific term that is expressed as:</u>**

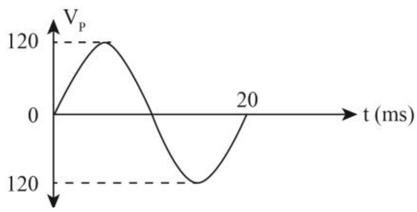
Spectrum occurring at specified frequencies or wavelengths and not continuously distributed.

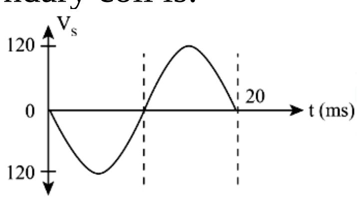
32. **<u>Write down the scientific term that is expressed as:</u>**

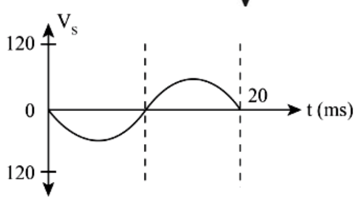
Exciting the atoms of the active medium in laser by optical energy.

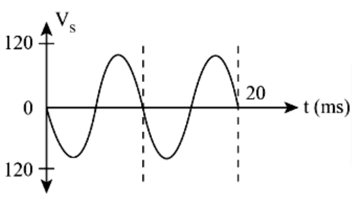
33. **<u>Choose the correct answer:</u>**

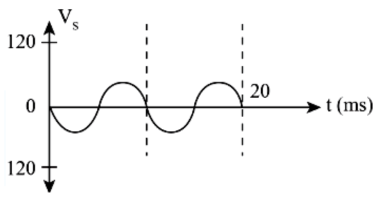
The graph represents the relation between the input voltage (V_P) versus time (t) in a step-down transformer.
So, the curve that represents the output voltage in the secondary coil is:



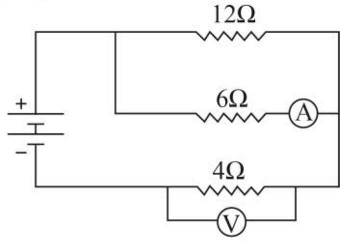
(A) 

(B) 

(C) 

(D) 

34. In the given circuit, the voltmeter reading is 4.8V.
What is the reading of the ammeter?



35. **Choose to answer (A) or (B):**
A. **Compare** in the p-n junction between forward bias and backward bias:
1. (With respect to the thickness of the depletion region).
2. (With respect to the possibility of passing a current through the junction).
B. **Draw** the circuit of a transistor (npn) as a switch in (ON) condition.

36. A sensitive galvanometer has a coil of resistance 40 Ω and its pointer deflects to full scale by a current of 5×10^{-3}A. A shunt resistance (R_s) is connected to it to be converted into an ammeter measuring a current of maximum 1A. **Calculate** the total resistance of the ammeter.

37. **Choose to answer (A) or (B): Give reason for:**
A. No current almost passes in the AC circuit that contains an inductive coil at very high frequencies, keeping the supply voltage constant.
B. The value of the alternating current in the oscillating circuit ceases with time.

38. A straight wire is coiled as a circular coil of 5 turns. An electric current of intensity (I) has passed through it to produce magnetic flux of density (B_1) at its center. The wire is recoiled another time as one circular turn and the same current intensity is passed through it. The magnetic flux density at its center becomes (B_2). **Find** the ratio: (B_1/B_2).

39. **Compare** between A.C dynamo and Electric motor (with respect to the scientific principle of its operation).

40. Blue light falls on a metal surface and photoelectrons are freed out. **What** is the effect of allowing ultra-violet rays having the same intensity to fall on the same surface?

41. **Give reason for:**
Concave magnetic poles are used in the analog electric-measuring instruments.

42. **When** is the potential difference between the poles of an electric cell, having an internal resistance, equal to its electro-motive force?

43. **Choose to answer (A) or (B): Give reason for:**
A. No emf is induced across a wire moving in a magnetic field.
B. Backward emf is induced in a secondary coil at the moment of switching on the circuit of a primary coil located inside it.

44. A solenoid carries an electric current. **What** would happen to the magnetic flux density at a point on its axis inside it when the spacing between its turns are reduced to half (keeping the cross-sectional area and the current intensity unchanged)?

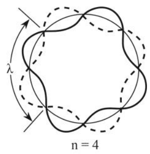
45. A rectangular coil carries an electric current and placed in a magnetic field of flux density 0.1 T at different angles. The table below records the torque acting on the coil (τ), and sine the angle between the direction of the magnetic dipole moment and the direction of the magnetic field (sinθ).

τ(N.m)	0.08	0.16	0.24	0.32	0.4
Sinθ	0.2	0.4	0.6	0.8	1

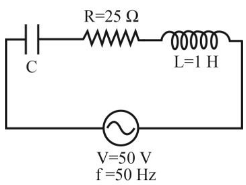
1) **Plot** the graphical relationship between torque (τ) on y-axis and (sinθ) on x-axis.
2) From the graph, **find** the magnetic dipole moment of the coil.

Model Trial Ministry Exam (2)

1. **Choose to answer (A) or (B): What is meant by?**
   A. The magnitude of the induced electromotive force is proportional to the rate by which the conductor cuts the lines of the magnetic flux linked with it and the number of turns of the conductor which cut the magnetic flux.
   B. The induced current must be in a direction such as to oppose the change producing it.
2. **Choose to answer (A) or (B): Mention ONE role of:**
   A. It is a metal surface which is heated by filament, thus some electrons are freed from the metal.
   B. They are used to control the electron beam to sweep the screen point by point so called raster until the frame (image) is completed.
3. **Choose to answer (A) or (B): Write down the scientific concept:**
   A. Electromotive force of a source. B. Conductivity of a material.
4. **Mention ONE use for:** It is used to determine the direction of motion of a straight wire when passing through it an electric current and placed normally to a magnetic field.
5. **Give reason for:**
   To minimize thermal energy in wire. **OR** Increase the efficiency of the transformer.



6. **Choose the correct answer:**
   (B) 2λ/π From rule: $r_n = n\lambda \setminus 2\pi$ $\because n = 4$ $\therefore r_n = 4\lambda \setminus 2\pi = 2\lambda \setminus \pi$
7. **First**: Yes the circuit will be in resonance state, because the impedance of the circuit equal the ohmic resistance in the circuit Z = V/I = 50/2 = 25Ω, so Z = R.



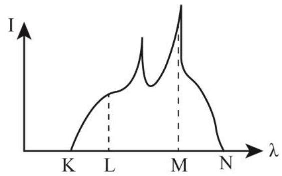
Second: From rule $f = \dfrac{1}{2\pi\sqrt{LC}}$ $C = \dfrac{1}{4\pi^2 f^2 L}$

$$C = \frac{1}{4\times(22/7)^2\times 50^2\times 1} \qquad C = 1.0124\times10^{-5}\,F$$

OR $X_L = 2\pi f L = 2\times(22/7)\times50\times1 = 314.28\Omega$ At resonance $X_C = X_L = 314.28\Omega$

$X_C = 1/2\pi f C$ $314.28 = 1/(2\times(22/7)\times50\times C)$ $C = 1.0124\times10^{-5}\,F$

8. **Choose the correct answer: (B) equal to**
   The two capacitors are connected together in series, then the quantity of charge will be constant.
9. $\theta = 360ft = 360\times50\times2.5\times10^{-3}$ $\theta = 45^\circ$
   $e.m.f_{inst} = e.m.f_{max}\sin\theta$ $e.m.f_{inst} = 100\sin45^\circ$ $e.m.f = 50\sqrt{2}V = 70.71V$
10. **Choose to answer (A) or (B): Mention ONE function of:**
    A. Adjust full-scale deflection of galvanometer when no unknown resistance is connected.
    B. It controls the rotational motion of the coil and it serves as leading current to the coil.
11. $P_W = \phi_L E$ $\phi_L = P_W / E = 30/(3\times10^{-19}) = 1\times10^{20}$ Photons / sec
12. Number of turns - Area of coil – Magnetic flux density – Angular velocity of coil
13. **Wavelength (M).**
    Because the wavelength (M) represents characteristic line spectrum which depends on high atomic number of target atom.
    $\Delta E_{target} = E_{x-ray} = h\upsilon_{x-ray} = hc/\lambda_{x-ray}$ Where $\Delta E = E_{outer} - E_{inner}$



14. **Choose the correct answer: (D) Collision with excited helium atoms.**
15. **Choose the correct answer: (A) 5V**
    $e.m.f_{av} = -N(\Delta\phi_m/\Delta t)$ $e.m.f = 500\times0.01 = 5V$ $e.m.f = 5V$

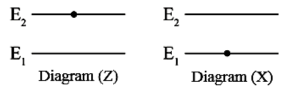
16. **Choose to answer (A) or (B):**

A.

Point of comparison	(OR) Gate having two inputs	(AND) Gate having two inputs
Number of cases to give (0) output	1 case When both inputs are (0)	3 cases When one of inputs is (1) And when both inputs are (0)

B. **First**: Positive holes and negative electrons.
Second: $np = n_i^2$ $(n = N_D^+)$ $(p = n_i^2/N_D^+)$

17. Diagram (Z): The stimulated emission will occur electron moves to state (E_1) emitting two photons with the same phase and energy.
Diagram (X): The atom will be excited to the higher state (E_2).



18. In series connection: $R_{eq} = 3R$ $\therefore I_T = V_B / R_{eq} = V_B / 3R$

In parallel connection: $R_{eq} = R/3$ $\therefore I_T = \frac{V_B}{R_{eq}} = \frac{V_B}{R/3} = \frac{3V_B}{R}$

$\therefore \frac{I_{T(series)}}{I_{T(parallel)}} = \frac{V_B}{3R} \div \frac{3V_B}{R}$ $\frac{I_{T(series)}}{I_{T(parallel)}} = \frac{V_B}{3R} \times \frac{R}{3V_B}$ $\therefore \frac{I_{T(series)}}{I_{T(parallel)}} = \frac{1}{9}$

19. **Choose to answer (A) or (B):Write down the mathematical relation used to calculate:** A. $X_C = 1/2\pi fC$ B. $Z = \sqrt{(R)^2 + (X_L)^2}$

20. **Choose to answer (A) or (B): Mention ONE application of:**
A. The transformer. B. Used in induction furnaces for melting metals.

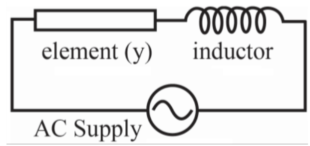
21. **Choose to answer (A) or (B):**
A. **(B) $I\sqrt{2}$** , From rule: $F = \mu I_1 I_2 L/(2\pi d)$ $(I_1 = I_2 = I)$ $F = \mu I^2 L/(2\pi d)$
$\because$ $F \alpha I^2$ and $F \alpha 1/d$ so if $(d\uparrow_2$ & $I^2\uparrow_2)$ then (F) remains the same.
When the distance (d) is increased to double, the both currents in the wires also increased to double, so the each wire will increase $(\sqrt{2})$ (to keep the force constant)

B.

Point of comparison	Hot-wire Ammeter	Sensitive galvanometer
Reason that makes the pointer settle at a definite reading on its scale	The rate of heat radiated from the wire becomes equal to the rate of heat generated in the wire	The torque is balanced with the spring torsion

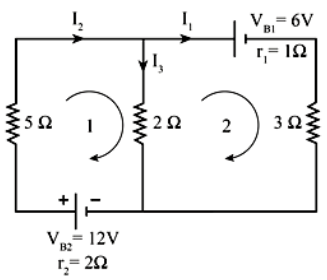
22. $\frac{\lambda_{max(1)}}{\lambda_{max(2)}} = \frac{T_2}{T_1}$ $\frac{0.5\times10^{-6}}{\lambda_{max(2)}} = \frac{300}{6000}$ $\lambda_{earth} = 1\times10^{-5}m = 10\mu m$

23. **Choose the correct answer:**
(B) an inductive coil of negligible resistance.
As in pure elements $V_T = V_1 + V_2$ so $V_T = V_{L_1} + V_{L_2}$



24. $E_n = (-13.6/n^2)(eV)$ $-1.51 = -13.6/n^2$ $n^2 = 9$ $n = 3$ $\therefore$ energy level is the third

25. $I_2 = I_1 + I_3$ $-I_1 + I_2 - I_3 = 0 \rightarrow (1)$
$5I_2 + 2I_3 + 2I_2 - 12 = 0$ $0I_1 + 7I_2 + 2I_3 = 12 \rightarrow (2)$
$3I_1 - 2I_3 + 1I_1 + 6 = 0$ $4I_1 + 0I_2 - 2I_3 = -6 \rightarrow (3)$
$I_1 = -3/5 = -0.6A$ $I_2 = 6/5 = 1.2A$ $I_3 = 9/5 = 1.8A$
So I_1 = - 0.6A



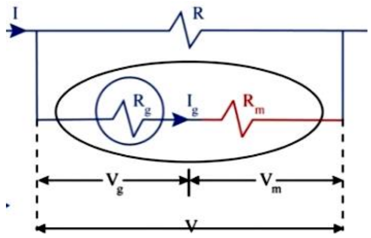
26. They are unwanted signals caused by the random motion of electrons causing minute randomly varying currents interfering with and disturbing the information. The disturbance affects on the analog signal where noise interfere with the analog signal which carry the information and disturb it.

27. The voltage difference across the coil is : $V_g = I_g R_g$

The maximum voltage drop to be measured is:

$V = V_g + V_m$ $\qquad$ $V = V_g + I_g R_m$

$\therefore R_m = \dfrac{V - V_g}{I_g}$ Where $V_g = I_g R_g$ So $R_m = \dfrac{V - I_g R_g}{I_g}$



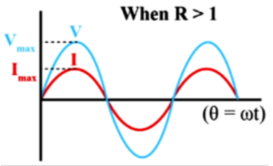
28. **Choose to answer (A) or (B): What happens when?**

A. The consumed power increases (increase energy loss in the wires).

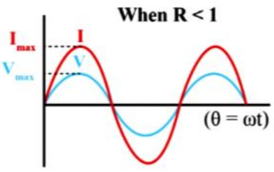
B. When the coil plane is parallel to the magnetic flux lines, the torque will be maximum while the coil plane is perpendicular to the magnetic flux lines, the torque will reach to zero, and it completes rotating due to its inertia.

29.

Point of comparison	The electron	The photon
Electric charge	Negative charge	No charge

30. 

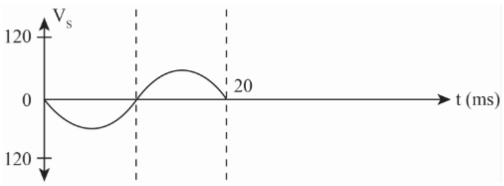
OR



31. **Write down the scientific term that is expressed as:** Line spectrum.

32. **Write down the scientific term that is expressed as:** Optical pumping.

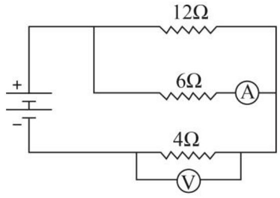
33. **Choose the correct answer:**

(B) 

34. $V = IR$ $\qquad$ $4.8 = I \times 4$ $\qquad$ $I_T = 4.8/4 = 1.2A$

From rule of current divider $I_{6\Omega} = \dfrac{12}{6+12} \times 1.2$

$I_{6\Omega} = 0.8A$ $\qquad$ $\therefore$ The reading of ammeter is 0.8A

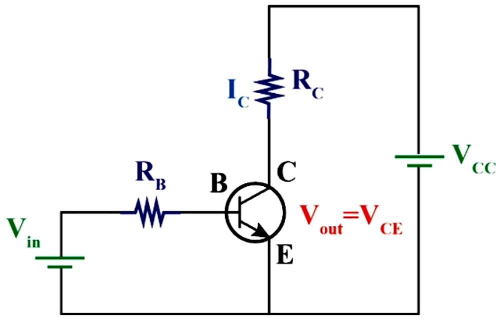


35. **Choose to answer (A) or (B):**

A.

Point of comparison	Forward bias	Reverse bias
Thickness of the depletion region	Small	Large
Possibility of passing a current through the junction	High possibility of passing current	Very low possibility of passing current (almost 0)

B. Transistor as a switch (ON) condition.



36. From rule: $R_S = \frac{I_g R_g}{I - I_g}$ $\qquad R_S = \frac{5\times10^{-3}\times40}{1-5\times10^{-3}}$ $\qquad R_S = 0.201\Omega$

$R_T = \frac{R_g \times R_S}{R_g + R_S}$ $\qquad R_T = \frac{40\times0.201}{40+0.201}$ $\qquad R_T = 0.2\Omega$

37. **<u>Choose to answer (A) or (B): Give reason for:</u>**

A. Since $X_L = 2\pi fL$, the inductive reactance is directly proportional with the frequency so at high frequency, inductive frequency will be large which acts as open circuit (I = 0).

B. Due to the ohmic resistance in the coil and the other circuit wiring, a part of energy is dissipated as heat energy so the damping oscillation happens.

38. $\frac{B_1}{B_2} = \frac{\mu}{\mu}\times\frac{N_1}{N_2}\times\frac{I_1}{I_2}\times\frac{r_2}{r_1}$ $\qquad \because \mu$ & I are constant.

$\because \frac{N_1}{N_2} = \frac{r_2}{r_1} = \frac{5}{1}$ $\qquad \therefore \frac{B_1}{B_2} = \frac{N_1}{N_2}\times\frac{r_2}{r_1} = \frac{5}{1}\times\frac{5}{1} = \frac{25}{1}$

39.

Point of comparison	AC dynamo	Electric motor
The Scientific principle of its operation	Electromagnetic induction (An induced emf and also induced current are generated in the coil by changing the magnetic flux cutting it).	The torque that is generated on a coil carrying current placed in a magnetic field.

40. When ultra-violet rays falls on a metal surface, the photoelectrons will be free with higher kinetic energy and higher velocity.

41. **<u>Give reason for:</u>**

Because the magnetic flux lines is radially directed which makes the magnetic flux density constant in the gap where the coil moves irrespective to the angle of the coil.

42. When no current flows in the circuit (open circuit "I = 0") As ($V = V_B - Ir$).

43. **<u>Choose to answer (A) or (B): Give reason for:</u>**

A. As the wire is moving parallel to the magnetic field and since emf = BLvSinθ and θ = 0°, so emf = 0.

B. Due to the increase in the magnetic flux density linked with the coil with time, so induced emf in the secondary coil will be produced and the induced emf will be in opposite direction to that in the primary coil to resist the increase in the affecting magnetic flux in the primary (Lenz's rule).

44. The magnetic flux density at a point on the solenoid axis inside it will be **increase to double**, because the magnetic flux density in the interior of a solenoid is inversely proportional with the length of solenoid according to rule ($B = \mu NI/L$), where the other factors are constant.

45. $\tau = B\left|\overrightarrow{m_d}\right|\text{Sin}(\theta)$

$\text{Slope} = \frac{\tau}{\text{Sin}\theta} = B\overrightarrow{m_d}$

$\text{Slope} = \frac{\Delta Y}{\Delta X} = \frac{(0.16-0.08)}{(0.4-0.2)} = 0.4$

$0.4 = 0.1\overrightarrow{m_d}$ $\qquad \overrightarrow{m_d} = 4\,\text{Amp.m}^2$