

Section-A

Multiple Choice Questions (MCQ's)

Q.1: Choose the correct answer for each from the given options:

(i) If the coefficient of linear expansion of a solid is 0.0009, its co-efficient of volume expansion is:

- (a) 0.00003 (b) 0.00009 (c) 0.00018 (d) 0.0027

(ii) Absolute zero on Fahrenheit scale is equal to:

- (a) -523°F (b) -273°F (c) -460°F (d) -491°F

(iii) The resistance of a wire is R ohm. If the wire is stretched to double its length, its resistance becomes:

- (a) $2R$ (b) $R/2$ (c) $R/4$ (d) $4R$

(iv) Direction of electric field intensity is always _____ to the electric field lines at every point.

- (a) Parallel (b) Tangent (c) Perpendicular (d) None of these

(v) Two capacitors of capacitance $2C$ and C respectively are connected in series, their equivalent capacitance becomes:

- (a) $2C$ (b) $C/2$ (c) $2C/3$ (d) $3C/2$

(vi) Resistance of a substance can be expected to increase for all of the following situation except:

- (a) Increase in cross-sectional area
- (b) Increase in length
- (c) Increase in temperature
- (d) Increase in resistivity of the material

(vii) Electron volt is a unit of:

- (a) Work
- (b) Frequency
- (c) Potential difference
- (d) Energy

(viii) Isobaric changes in a gas show that there is no change in:

- (i) Internal energy
- (b) Pressure
- (c) Volume
- (d) Temperature

(ix) Two parallel wires carrying current in same directions:

- (a) Repel each other
- (b) Attract each other
- (c) Neither attract nor repel
- (d) Cancel each other's field

(x) A positron is anti particle of:

- (a) Photon
- (b) Electron
- (c) Proton
- (d) Neutron

(xi) When the temperature of source and sink of a heat engine becomes equal, the entropy of the system becomes:

- (a) Zero
- (b) Same
- (c) Minimum
- (d) Maximum

- (xii) When the forward bias is applied to a p-n junction the concentration of electrons on p side:
- (a) Increase slightly (b) Increases dramatically
(c) Decrease slightly (d) Decreases dramatically
- (xiii) An apparatus used to compare the emf of two cells is:
- (a) Volt meter (b) Avo meter (c) Galvanometer
(d) Potentiometer
- (xiv) 1 atomic mass unit (a.m.u) in terms of energy is nearly equal to:
- (a) 931 MeV (b) 931 KeV (c) 139 MeV (d) 193 KeV
- (xv) Which one of the following is NOT needed in a nuclear fission reaction?
- (a) Moderator (b) Fuel (c) Coolant (d) Accelerator
- (xvi) Bulk of the mass of an atom is concentrated in its:
- (a) Electron shells (b) Nucleus (c) Protons (d) Neutrons
- (xvii) Which of the following is one of the functions performed by a diode?
- (a) Amplifier (b) Filter (c) Rectifier (d) Inverter

Section-B

(Short Answer)

Note: Answer any EIGHT to the following questions. Each question carries 05 marks

- Q.2: Calculate the speed of an electron, if it possesses 60 eV energy.
- Q.3: Define co-efficient of linear and volume expansion. Show that co-efficient of linear expansion of the material of a substance is one third of the co-efficient of volume expansion.
- Q.4: Why heat is produced in a conductor when electric current flows through it?
- Q.5: Describe mutual induction with the help of the diagram and define henry.
- Q.6: Write any Five applications of LASER.
- Q.7: What will be the energy of an X-ray photon of wave length $2.0 \times 10^{-16} \text{ m}$.
- Q.8: Why the rest mass of a photon is zero? Explain.
- Q.9: If an electron and a proton have the same De-Broglie wave length, which particle has greater speed?
- Q.10: Find the speed at which the mass of a proton is twice of its rest mass?
- Q.11: Both potential difference and electromotive force are measured in volt. Are they same? Explain.
- Q.12: Write five properties of good coolant used in nuclear reactor.
- Q.13: A wire carries an electric current of one ampere. How many electrons pass through the wire in one second?

Section-C

(Descriptive Answer)

Note: Answer any TWO of the following questions. Each question carries 14(7+7) marks.

Q.14(a): Why a gas has two specific heats? show that molar specific heat of a gas at constant pressure is equal to sum of its specific heat at constant volume and molar gas constant.

(b) Explain photoelectric effect on quantum theory and show that no photoelectron can be ejected from a metal surface, if frequency of the incident light is less than its critical value.

Q.15(a): Deriv an expression for the force experienced by a current carrying conductor placed in a uniform magnetic field.

(b) What are the basic postulates of Bohr's atomic theory? Derive an expression for energy of the electron in n th orbit of a hydrogen atom?

Q.16(a): Write notes on any TWO of the following:

(i) Parallel Plate Capacitor

(ii) Potentiometer

(iii) Radioactivity and Half life

(iv) Power dissipation through a resistor

Section-A**Q.1 Choose the Correct Answers:**

- (1) If the temperature of a cold body decreases, efficiency of heat engine will _____.
- (a) Increase (b) Decrease (c) Remains same (d) None of these
- (2) Normal human body temperature on Celsius scale is _____ °C.
- (a) 37 (b) 40.6 (c) 98.6 (d) 96.4
- (3) Two parallel conductors carrying current in same direction, they _____.
- (a) Attract each other (b) Repel each other
(c) Neutralize each other (d) None of these
- (4) Lenz's Law predicts the _____.
- (a) Direction of induced emf (b) Direction of induced current
(c) Magnitude of induced emf (d) Magnitude of induced current
- (5) S.I Unit of co-efficient of thermal expansion is:
- (a) K⁻¹ (b) K (c) mK (d) m/k
- (6) By moving a charge of 20 Coulombs 200 J of work is done, then the potential difference between the points.
- (a) 10V (b) 8 V (c) 5 V (d) 2 V

(7) If we increase the distance between two plates of the capacitor, the capacitance will:

- (a) Increase (b) Decrease (c) Remains same
(d) First increase then decrease

(8) The total resistance in a series is equals to:

- (a) Product of all resistance (b) Sum of all resistance
(c) Half of the sum of all resistance (d) None of these

(9) Laser is an intense beam of light, which is:

- (a) Monochromatic (b) Coherent
(c) Collimated (d) All of these

(10) X-rays have the same essential nature as :

- (a) Alpha rays (b) Beta rays (c) Gamma rays (d) Positive rays

(11) The process of scattering of an X-ray photon by an electron is called:

- (a) Compton effect (b) Photoelectric effect (c) Pair production
(d) Annihilation

(12) Half life of a radioactive element can be calculated by formula:

- (a) (b) (c) (d)

(13) Ammeter always connected _____ in circuit.

- (a) Perpendicular (b) Parallel (c) Series (d) None of these

(14) For pair production the minimum energy of photon is _____

- (a) 0.76 MeV (b) 0.511 MeV (c) 2.11 MeV (d) 1.022 MeV

- (15) The amount of energy equivalent 1 a.m.u is _____
(a) 931.5 MeV (b) 0.511 MeV (c) 2.11 MeV (d) 1.022 MeV
- (16) S.I unit of electric field intensity is :
(a) N/S (b) N/C (c) 0.315 MeV (d) 0.9315 MeV
- (17) The intensity of magnetic field near its pole is _____
(a) Zero (b) Maximum (c) Minimum (d) Variable
- (18) In electromagnetic waves electric and magnetic fields are:
(a) Parallel to each other (b) Perpendicular to each other
(c) Opposite to each other (d) None of these
- (19) For each material emission occurs only for certain definite frequency of light called:
(a) Critical frequency (b) Threshold frequency
(c) High frequency (d) None of these
- (20) Number of electron in one Coulomb charge are :
(a) 9.11×10^{-31} (b) 1.6×10^{-10} (c) 8.25×10^{16} (d) 0.25×10^{-18}
- (21) The nucleus of hydrogen with symbol ${}^3\text{H}$ is called:
(a) Proton (b) Deuterium (c) Tritium (d) All of these
- (22) In Isothermal process:
(a) $\Delta U = \Delta W$ (b) $\Delta U = \Delta W$ (c) $VQ = WU$ (d) $\Delta Q = \Delta W$
- (23) Unstable isotopes are called:
(a) isobars (b) Isomers (c) Radioactive (d) None of these
- (24) Light consists of particles known as:
(a) Protons (b) Electrons (c) Neutrons (d) Photons

- (25) Mass of Positron equal to mass of:
(a) Proton (b) Neutron (c) Electron (d) Photons
- (26) Unit of Plank's constant is same as the unit of:
(a) Energy (b) Power
(c) Linear momentum (d) Angular momentum
- (27) S.I unit of electric current is Ampere and one Ampere is equal to:
(a) 1 Joule / sec (b) 1 volt / sec (c) 1 Coulomb / sec (d) None of these
- (28) The resistance of a conductor does not depends upon its _____
(a) Length (b) Area of cross-section
(c) Resistivity (d) Mass
- (29) The smaller unit of magnetic induction is Gauss, and Gauss related to tesla as _____
(a) $1\text{T} = 10^4\text{G}$ (b) $1\text{T} = 10^{-4}\text{G}$ (c) $1\text{T} = 10^3\text{G}$ (d) $1\text{T} = 10^{-3}\text{G}$
- (30) The process in which the original signal recovered is known as :
(a) Demodulation (b) Detection (c) Both (a) and (b)

- (d) Transmission
- (31) Radio waves of wave length 300 m having frequency of:
(a) 10^3KHz (b) 500 KHz (c) 1MHz (d) 8 MHz
- (32) A particle with rest mass m_0 has total energy $\frac{5}{3} m_0 c^2$ the its K.E is _____
(a) $\frac{1}{3} m_0 c^2$ (b) $\frac{2}{3} m_0 c^2$ (c) $\frac{4}{3} m_0 c^2$ (d) $\frac{7}{3} m_0 c^2$
- (33) What will be the resistance, if current flowing through a conductor is 10 amp and voltage is 220 Volts.
(a) 20hms (b) 1.5 Ohms (c) 0.5 Ohms (d) 22 Ohms
- (34) A field of 1C is moving perpendicular to the magnetic field of 0.5 tesla with velocity of 10 m/sec.
(a) 5N (b) 0.5 N (c) 10 N (d) 0 N

- (a) 5N (b) 0.5 N (c) 10 N (d) 0 N
- (35) Transistor in a circuit basically acts as:
(a) Voltage amplifier (b) Current amplifier (c) power amplifier
(d) Rectifier
- (36) If the quantity of charge on each of two bodies is doubled. The force between them becomes:
(a) Twice (b) Four times (c) Nine times (d) Sixteen times
- (37) Kelvin temperature equal to:
(a) $273 + ^\circ\text{C}$ (b) $273 - ^\circ\text{C}$ (c) $273 + ^\circ\text{F}$ (d) $273 - ^\circ\text{F}$
- (38) Two capacitors of capacitance $2C$ and C respectively are connected in series, their equivalent capacitance becomes.
(a) $2C$ (b) $C/2$ (c) $2C/3$ (d) $3C/2$
- (39) Electron volt is the unit of:
(a) Work (b) Frequency (c) Potential difference (d) Energy
- (40) Decay constant of a radioactive element is inversely proportional to ____
(a) Activity (b) Half life (c) mean life (d) Wave length
- (41) In P-type semi-conductors the majority of charge carries are:
(a) Electrons (b) Holes (c) Neutrons (d) Protons
- (42) Isobaric changed in a gas show that there is no change in:
(a) Internal energy (b) Pressure (c) Volume (d) Temperature
- (43) Fahrenheit and Celsius scales coincide at:
(a) 273 (b) -40 (c) 0 (d) 32

Section-B

(Short Answer)

Note: Answer any SIX of the following questions.

- Q.2 A heat engine operates between two reservoirs at temperatures of 25°C and 300°C . What will be its maximum efficiency?
- Q.3 Why the resistance of conductor is inversely proportional to the area of cross-section of conductor?
- Q.4 Define electromotive force and electric field intensity. And what are their Units.
- Q.5 Define henry and describe the mutual induction of pair of coils with the help of diagram.
- Q.6 We want to convert galvanometer into (a) an ammeter and (b) a voltmeter. What to do in each case?
- Q.7 What is the difference between Fission and Fusion reaction? Why Fusion reaction is more difficult to achieve?
- Q.8 Two capacitors of $3\mu\text{F}$ and $9\mu\text{F}$, are joined in series and a potential difference of 200 Volts applied. Find P.D for each capacitor.
- Q.9 What are the advantages and disadvantages of X-ray? Write some of its applications.
- Q.10 Explain. Why does the resistance of a conductor rise with the rise in temperature?

Section-C

(Descriptive Answer)

Note: Answer any TWO of the following questions.

- Q.11 Describe the cyclic process of a Carnot Heat engine and derive the expression for its efficiency.
- Q.12 Determine the equivalent capacitance of three capacitors of capacitance C_1 , C_2 and C_3 . When connected in (i) series and (ii) Parallel.
- Q.13 Write notes on any TWO of the following:
- (a) Photoelectric effect
 - (b) Force on current carrying conductor placed in a uniform magnetic field.
 - (c) Transformer.

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SECTION - A (Multiple Choice Questions)

Q.1 Choose the correct answer for each from the given options:

1. Mathematical expression for potentiometer is given by _____.

- (a) $\frac{E_1}{E_2} = \frac{L_1}{L_2}$ (b) $\frac{E_1}{E_2} = \frac{L_2}{L_1}$ (c) $E_1 L_1 = E_2 L_2$ (d) $E_1 E_2 = L_1 L_2$

2. P.O Box is used for the measure _____.

- (a) Current (b) Voltage (c) emf (d) Resistance

3. The process in which alternative current into direct current is _____.

- (a) Amplification (b) Rectification (c) Both a and b (d) None of these

4. Momentum of photon, from the theory of relativity is related by _____

- (a) $P = \frac{hc}{f}$ (b) $P = \frac{hf}{c}$ (c) $P = hcf$ (d) None of these

5. If energy of incident photon is less than _____ no pair production will take place.

- (a) 0.311 Mev (b) 3.5 Mev (c) $m_0 c^2$ (d) $2 m_0 c^2$

6. The wavelength of last spectral line is Lyman series is equal to

- (a) R_H (b) R_H^2 (c) $\frac{1}{R_H}$ (d) $\frac{1}{R_H^2}$

7. The energy of X-ray photon is _____ the energy of photon of ultra-violet light.

- (a) Equal to (b) Less than
(c) Greater than (d) Depends on velocity of

8. Due to the alpha decay the mass number of atom _____.

- (a) Decreased by two (b) Decreased by four
(c) Increased by two (d) Increased by four

9. Lenz's law is in accordance with the law of conservation of _____.

- (a) Momentum (b) Energy (c) Angular Momentum (d) All of these

10. The transformer in which secondary voltage is less than primary voltage is called _____.

- (a) Step up Transformer (b) Step down Transformer
(c) Rectifier (d) Amplifier

11. The transformer has 1000 turns in the primary and 200 in the secondary, if input current is 2A. What will be its output current?

- (a) 10 A (b) 0.4 A (c) 12 A (d) None of these

12. _____ is a device that raises the strength of a weak signal.

- (a) Transistor (b) Amplifier (c) Ammeter (d) Voltmeter

13. Photocell is a device which converts _____ energy into _____ energy.

- (a) Chemical, Light (b) Light, Electrical
(c) Chemical, Electrical (d) Electrical, Light

14. The speed of x-ray photon is always _____.
- (a) Equal to C (b) Greater than C
(c) Less than C (d) Depends upon intensity
15. The Balmer series lies in the _____.
- (a) Infrared region (b) For infrared region
(c) Ultraviolet region (d) Visible region
16. In any reaction ${}_{90}\text{Th}^{227}$ makes alpha decay the daughter element will be

- (a) ${}_{36}\text{Kr}^{89}$ (b) ${}_{56}\text{Br}^{144}$ (c) ${}_{92}\text{U}^{235}$ (d) ${}_{88}\text{Ra}^{223}$
17. The quantity of matter such that its mass in grams is numerically equal to the

- (a) Molecular Formula (b) Molecular Weight
(c) One Mole (d) Suspected Mass
18. In an isobaric process the work done is equal to _____.
- (a) $\frac{R \Delta V}{n}$ (b) $\frac{C_p}{n \Delta T}$ (c) $\frac{C_p}{n \Delta V}$ (d) $n R \Delta T$

19. The S.I unit of electric field intensity is _____.
- (a) Newton / Coulomb (b) Volt / Meter
(c) Both (a) and (b) (d) None of these

20. Electron volt is the unit of _____.
(a) Power (b) Energy
(c) Potential Difference (d) Both a and c
21. What is a current passing in 5×10^6 ohm resistor if it is provided p.d of 5KV?
(a) 10^{-1} A (b) 10^{-4} A (c) 1 m A (d) None of these
22. If one ampere current flow through a conductor for one hour, how much charges flow through area of cross section of conductor?
(a) 3600 C (b) 7.2×10^3 (c) 1 C (d) None of these
23. Tesla is the unit of _____.
(a) Magnetic Flux (b) Electric Flux
(c) Magnetic flux Density (d) None of these
24. The direction of induced current in a certain coil can easily be found by using _____.
(a) Right hand rule (b) Faraday's law
(c) Lenz's law (d) Both (a) and (b)
25. The penetrating power of neutron is _____.
(a) Zero (b) Very low (c) Medium (d) Very high
26. The specific heat of water is _____.
(a) 4.2×10^5 Joule (b) One kilo Calorie
(c) One Calorie (d) None of these

27. Heat can not be measured in _____.
(a) Calorie (b) B.T.U (c) Joule (d) Centigrade
28. The Coulomb's force _____ when any material medium is placed between two charges.
(a) Increases (b) Decreases
(c) Remains Same (d) None of these
29. The surface density of charge is defined as charge per unit _____.
(a) Volume (b) Length (c) Area (d) Mass
30. 1 Coulomb per one volt is equal to _____.
(a) One Joule (b) One Ampere
(c) One Calorie (d) One Farad
31. The graph between current and voltage for ohm's law is _____.
(a) Hyperbola (b) Ellipse (c) Straight Line (d) Parabola
32. Which of the following is not a unit of magnetic field induction is _____.
(a) Tesla (b) $\frac{\text{Newton}}{\text{Ampere Meter}}$ (c) $\frac{\text{Weber}}{\text{Meter}^2}$ (d) Newton per volt

SECTION - B (SHORT ANSWER)

Note: Answer any SEVEN of the following questions. Each question carries 05 marks.

- Q.2 Prove that co-efficient of linear expansion is one third to co-efficient of volume expansion.
- Q.3 Calculate electric intensity due to a sheet of infinite charges distributed uniformly.
- Q.4 Can you construct two wires of same length, one of copper other of iron that would have the same resistance at same temperature? Explain.
- Q.5 Why work done by a charge due to magnetic force is zero?
- Q.6 How a single device is used to measure the resistance, current and potential?
- Q.7 Why are the energy levels of hydrogen atom less than zero?
- Q.8 How the photon is different from the matter?
- Q.9 The battery of a pocket calculator supplies 0.25 A at a p.d of 8V. What is the power rating of the calculator?
- Q.10 Calculate the energy of x-ray photon having wavelength $2 \times 10^{-10} \text{ m}$.
- Q.11 What is the wavelength of the radiation that is emitted when a hydrogen atom undergoes a transition from the state $n = 3$ to $n = 1$.

SECTION - C (DESCRIPTIVE ANSWER)

Note: Answer any TWO of the following questions. Each question carries 09 (5 + 4) marks.

- Q.12 (a) What is specific heat and molar specific heat? Show that $C_p - C_v = R$.
(b) Describe Bohr's atomic Model. Hence calculate the energy in n^{th} orbit.
- Q.13 (a) What is charge to mass ratio of an electron? How it is calculated by different two methods?
(b) What are the assumptions of theory of relativity? And write the results of special theory of relativity.
- Q.14 Write the notes on any TWO of the following.
- (i) Wheatstone Bridge
 - (ii) Power Dissipation in Resistor
 - (iii) Nuclear Fission and Fusion
 - (iv) A.C Generator