INDRAPRASTHA CET

## Engineering Entrance Exam

Physics

1. The width of the diffraction band varies
   (a) inversely as the wavelength
   (b) directly as the width of the slit
   (c) directly as the distance between the slit and the screen
   (d) inversely as the size of the source from which the slit is illuminated

2. An unpolarised beam of intensity I_0 is incident on a pair of nicols making an angle of 60° with each other. The intensity of light emerging from the pair is
   (a) I_0
   (b) $I_0/2$
   (c) $I_0/4$
   (d) $I_0/8$

3. A cyclist starts from the centre O of a circular park of radius 1 km, reaches the edge P of the park, then cycles along the circumference and returns to the centre along QO as shown in the figure. If the round trip takes 10 min, the net displacement and average speed of the cyclist (in metre and kilometre per hour) are
   (a) 0, 1
   (b) $\dfrac{\pi+4}{2}$, 0
   (c) 21.4, $\dfrac{\pi+4}{2}$
   (d) 0, 21.4
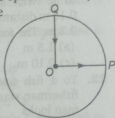
4. A beam of light of wavelength 600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2m away. The distance between the first dark fringes on either side of the central bright fringe is
   (a) 1.2 cm
   (b) 1.2 mm
   (c) 2.4 cm
   (d) 2.4 mm

5. The physical quantity having the dimensions $[M^{-1}L^{-3}T^3A^2]$ is

   (a) resistance
   (b) resistivity
   (c) electrical conductivity
   (d) electromotive force

6. A battery of emf 10 V and internal resistance $3\,\Omega$ is connected to a resistor. The current in the circuit is 0.5 A. The terminal voltage of the battery when the circuit is closed is
   (a) 10 V
   (b) zero
   (c) 1.5 V
   (d) 8.5 V

7. A galvanometer coil has a resistance of 15 Ω and gives full scale deflection for a current of 4 mA. To convert it to an ammeter of range 0 to 6 A
   (a) 10 m Ω resistance is to be connected in parallel to the galvanometer
   (b) 10 m Ω resistance is to be connected in series with the galvanometer
   (c) 0.1 Ω resistance is to be connected in parallel to the galvanometer
   (d) $0.1\,\Omega$ resistance is to be connected in series with the galvanometer

8. A straight wire of mass 200 g and length 1.5 m carries a current of 2 A. It is suspended in mid air by a uniform horizontal magnetic field B. The magnitude of B (in tesla) is (assume that $g = 9.8$ ms^{-2})
   (a) 2
   (b) 1.5
   (c) 0.55
   (d) 0.65

9. In the circuit shown the value of I in ampere is
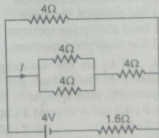
   (a) 1
   (b) 0.60
   (c) 0.4
   (d) 1.5

1. A sphere encloses an electric dipole within it. The total flux across the sphere is
   (a) zero
   (b) half that due to a single charge
   (c) double that due to a single charge
   (d) dependent on the position of the dipole

11. A parallel plate air capacitor has a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increases in the capacitance will be
    (a) 400%   (b) 66.6%
    (c) 33.3%   (d) 200%

12. A comb run through one's dry hair attracts small bits of paper. This is due to
    (a) comb is a good conductor
    (b) paper is a good conductor
    (c) the atoms in the paper get polarised by the charged comb
    (d) the comb possesses magnetic properties

13. The specific charge of a proton is 9.6×10^7 C kg^{-1}. The specific charge of an alpha particle will be
    (a) 9.6×10^7 Ckg^{-1}
    (b) 19.2×10^7 Ckg^{-1}
    (c) 4.8×10^7 Ckg^{-1}
    (d) 2.4×10^7 Ckg^{-1}

14. When light of wavelength 300 nm falls on a photoelectric emitter, photoelectrons are liberated. For another emitter, light of wavelength 600 nm is sufficient for liberating photoelectrons. The ratio of the work function of the two emitters is
    (a) 1 : 2   (b) 2 : 1
    (c) 4 : 1   (d) 1 : 4

15. White light is passed through a dilute solution of potassium permanganate. The spectrum produced by the emergent light is
    (a) band emission spectrum
    (b) line emission spectrum
    (c) band absorption spectrum
    (d) line absorption spectrum

16. If λ_1 and λ_2 are the wavelengths of the first members of the Lyman and Paschen series respectively, then $\lambda_1 : \lambda_2$ is
    (a) 1 : 3   (b) 1 : 30
    (c) 7 : 50   (d) 7 : 108

17. Activity of a radioactive sample decreases to $(1/3)^{rd}$ of its original value in 3 days. Then, in 9 days its activity will become

    (a) (1/27) of the original value
    (b) (1/9) of the original value
    (c) (1/18) of the original value
    (d) (1/3) of the original value

18. In a transistor the collector current is always less than the emitter current because
    (a) collector side is reverse biased and the emitter side is forward biased
    (b) a few electrons are lost in the base and only remaining ones reach the collector
    (c) collector being reverse biased, attracts less electrons
    (d) collector side is forward biased and emitter side is reverse biased

19. A transparent cube of 0.21 m edge contains a small air bubble. Its apparent distance when viewed through one face of the cube is 0.10 m and when viewed from the opposite face is 0.04 m. The actual distance of the bubble from the second face of the cube is
    (a) 0.06 m   (b) 0.17 m
    (c) 0.05 m   (d) 0.04 m

20. White light is incident on one of the refracting surfaces of a prism of angle 5°. If the refractive indices for red and blue colours are 1.641 and 1.659 respectively, the angular separation between these two colours when they emerge out of the prism is
    (a) 0.9°   (b) 0.09°
    (c) 1.8°   (d) 1.2°

21. For a given lens, the magnification was found to be twice as large as when the object was 0.15 m distant from it as when the distance was 0.2 m. The focal length of the lens is
    (a) 1.5 m   (b) 0.20 m
    (c) 0.10 m   (d) 0.05 m

22. To a fish under water, viewing obliquely a fisherman standing on the bank of a lake, the man looks
    (a) taller than what he actually is
    (b) shorter than what he actually is
    (c) the same height as he actually is
    (d) depends on the obliquity

23. A thin prism P_1 with angle 4° made from a glass of refractive index 1.54 is combined with another thin prism P_2 made from glass of refractive index 1.72 to produce dispersion without deviation. The angle of the prism P_2 is
    (a) 5.33°   (b) 4°
    (c) 3°   (d) 2.6°

24. Specific rotation of sugar solution is 0.5 deg m^2/kg. 200 kg-m^{-3} of impure sugar solution is taken in a sample polarimeter tube of length 20 cm and optical rotation is found to be 19°. The percentage of purity of sugar is
(a) 20% (b) 80%
(c) 95% (d) 89%

25. A simple pendulum has a length l and the mass of the bob is m. The bob is given a charge of q coulomb. The pendulum is suspended between the vertical plates of a charged parallel plate capacitor. If E is the electric field strength between the plates, the time period of the pendulum is given by

(a) $2\pi\sqrt{\dfrac{l}{g}}$

(b) $2\pi\sqrt{\dfrac{l}{g+\dfrac{qE}{m}}}$

(c) $2\pi\sqrt{\dfrac{l}{g-\dfrac{qE}{m}}}$

(d) $2\pi\sqrt{\dfrac{l}{g^2+\left(\dfrac{qE}{m}\right)^2}}$

26. A satellite in a circular orbit of radius R has a period of 4 h. Another satellite with orbital radius $3R$ around the same planet will have a period (in hours)
(a) 16 (b) 4
(c) $4\sqrt{27}$ (d) $4\sqrt{8}$

27. The freezer in a refrigerator is located at the top section so that
(a) the entire chamber of the refrigerator is cooled quickly due to convection
(b) the motor is not heated
(c) the heat gained from the environment is high
(d) the heat gained from the environment is low

28. The unit of Stefan's constant is
(a) Wm^{-2}K^{-1} (b) WmK^{-4}
(c) Wm^{-2}K^{-4} (d) Nm^{-2}K^{-4}

29. A monoatomic gas is suddenly compressed to $(1/8)^{th}$ of its initial volume adiabatically. The ratio of its final pressure to the initial pressure is (Given the ratio of the specific heats of the given gas to be 5/3)
(a) 32 (b) 40/3
(c) 24/5 (d) 8

30. A Carnot engine takes heat from a reservoir at 627°C and rejects heat to a sink at 27°C. Its efficiency will be
(a) 3/5 (b) 1/3
(c) 2/3 (d) 200/209

31. A 30 V, 90 W lamp is to be operated on a 120 V DC line. For proper glow, a resistor of ..... Ω should be connected in series with the lamp.
(a) 40 (b) 10
(c) 20 (d) 30

32. A battery consists of a variable number (n) of identical cells, each having an internal resistance r connected in series. The terminals of the battery are short-circuited. A graph of current (I) in the circuit versus the number of cells will be as shown in figure

(a)   (b)

(c)   (d)
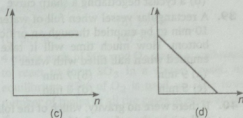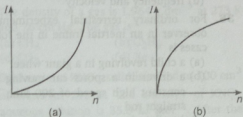
33. A tuning fork A produces 4 beat/s with another tuning fork B of frequency 320 Hz. On filing one of the prongs of A, 4 beat/s are again heard when sounded with the same fork B. Then, the frequency of the fork A before filing is
(a) 328 Hz (b) 316 Hz
(c) 324 Hz (d) 320 Hz

34. When the length of the vibrating segment of a sonometer wire is increased by 1%, the percentage change in its frequency is
(a) $\dfrac{100}{101}$ (b) $\dfrac{99}{100}$
(c) 1 (d) 2

35. The sprinkling of water reduces slightly the temperature of a closed room because
(a) temperature of water is less than that of the room
(b) specific heat of water is high
(c) water has large latent heat of vaporisation
(d) water is a bad conductor of heat

36. The equation of a simple harmonic wave is given by $y = 5 \sin \frac{\pi}{2}(100t - x)$, where x and y are in metre and time is in second. The period of the wave in second will be

(a) 0.04
(b) 0.01
(c) 1
(d) 5

37. The loudness and pitch of a sound note depends on

(a) intensity and frequency
(b) frequency and number of harmonics
(c) intensity and velocity
(d) frequency and velocity

38. For ordinary terrestrial experiments, the observer in an inertial frame in the following cases is

(a) a child revolving in a giant wheel
(b) a driver in a sports car moving with a constant high speed of 200 kmh^{-1} on a straight rod
(c) the pilot of an aeroplane which is taking off
(d) a cyclist negotiating a sharp curve

39. A rectangular vessel when full of water, takes 10 min to be emptied through an orifice in its bottom. How much time will it take to be emptied when half filled with water ?

(a) 9 min
(b) 7 min
(c) 5 min
(d) 3 min

40. If there were no gravity, which of the following will not be there for a fluid ?

(a) Viscosity
(b) Surface tension
(c) Pressure
(d) Archimedes' upward thrust

41. In a LCR series circuit, the potential difference between the terminals of the inductance is 60 V, between the terminals of the capacitor is 30 V and that across the resistance is 40 V. Then, supply voltage will be equal to

(a) 50 V
(b) 70 V
(c) 130 V
(d) 10 V

42. When deuterium and helium are subjected to an accelerating field simultaneously, then

(a) both acquire same energy
(b) deuterium accelerates faster
(c) helium accelerates faster
(d) neither of them is accelerated

43. A solenoid 1.5 m long and 4.0 cm in diameter possesses 10 turns per cm length. A current of 5 A falls through it. The magnetic field at the axis inside the solenoid is

(a) $2\pi \times 10^{-3}$ T
(b) $2\pi \times 10^{-5}$ T
(c) $4\pi \times 10^{-2}$ T
(d) $4\pi \times 10^{-3}$ T

44. A wire PQR is bent as shown in figure and is placed in a region of uniform magnetic field B. The length of $PQ = QR = L$. A current I ampere flows through the wire as shown. The magnitude of the force on PQ and QR will be

(a) BIl, 0
(b) $2BIl$, 0
(c) 0, BIl
(d) 0, 0

45. A choke is preferred to a resistance for limiting current in AC circuit because

(a) choke is cheap
(b) there is no wastage of power
(c) choke is compact in size
(d) choke is a good absorber of heat

46. To a germanium crystal equal number of aluminium and indium atoms are added. Then

(a) it remains an intrinsic semiconductor
(b) it becomes a n-type semiconductor
(c) it becomes a p-type semiconductor
(d) it becomes an insulator

47. Maximum velocity of the photoelectrons emitted by a metal surface is $1.2 \times 10^6 \text{ ms}^{-1}$. Assuming the specific charge of the electron to be 1.8×10^{11} Ckg^{-1}. The value of the stopping potential in volt will be

(a) 2
(b) 3
(c) 4
(d) 6

48. Which of the following figures represents the variation of particle momentum and associated de-Broglie wavelength?

(a)
(b)

Unfold Every Question
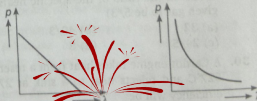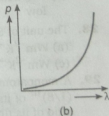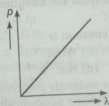
The term liquid crystal refers to a state that is intermediate between

(a) crystalline solid and amorphous liquid
(b) crystalline solid and vapour
(c) amorphous liquid and its vapour
(d) a crystal immersed in a liquid

50. If r_1 and r_2 are the radii of the atomic nuclei of mass number 64 and 125 respectively, then the ratio (r_1 / r_2) is

(a) $\dfrac{64}{125}$
(b) $\sqrt{\dfrac{64}{125}}$
(c) $\dfrac{5}{4}$
(d) $\dfrac{4}{5}$

Chemistry

1. Which of the following is not an ore of magnesium ?

(a) Carnallite
(b) Dolomite
(c) Calamine
(d) Sea water

2. The atomic number of Ni and Cu are 28 and 29 respectively. The electronic configuration $1s^2, 2s^2 \ 2p^6, 3s^2 \ 3p^6 \ 3d^{10}$ represents

(a) Cu^+
(b) Cu^{2+}
(c) Ni^{2+}
(d) Ni

3. In the following, the element with the highest ionisation energy is

(a) $[Ne]3s^2 \ 3p^3$
(b) $[Ne]3s^2 \ 3p^3$
(c) $[Ne]3s^2 \ 3p^2$
(d) $[Ne]3s^2 \ 3p^4$

4. In the conversion of Br_2 to BrO_3^-, the oxidation number of Br changes from

(a) zero to +5
(b) +1 to +5
(c) zero to –3
(d) +2 to +5

5. Among the alkali metals cesium is the most reactive because

(a) its incomplete shell is nearest to the nucleus
(b) it has a single electron in the valence shell
(c) it is the heaviest alkali metal
(d) the outermost electron is more loosely bound than the outermost electron of the other alkali metals

6. Which of the following represents the Lewis structure of N_2 molecule ?

(a) $\overset{\times\times}{N} \!\! \equiv \!\! \overset{\times\times}{N}$
(b) $\overset{\times\times}{N} \!\! = \!\! N$
(c) $N \!\! = \!\! N$
(d) $N \!\! = \!\! N$

7. Hydrogen bond is strongest in the

(a) $S - H \cdots O$
(b) $O - H \cdots S$
(c) $F - H \cdots F$
(d) $O - H \cdots N$

8. The decomposition of a certain mass of $CaCO_3$ gave 11.2 dm^3 of CO_2 gas at STP. The mass of KOH required to completely neutralise the gas is

(a) 56 g
(b) 28 g
(c) 42 g
(d) 20 g

9. The density of a gas is 1.964 g dm^{-3} at 273 K and 76 cm Hg. The gas is

(a) CH_4
(b) C_2H_6
(c) CO_2
(d) Xe

10. 0.06 mole of KNO_3 solid is added to 100 cm^3 of water at 298 K. The enthalpy of KNO_3 aqueous solution is 35.8 kJ mol^{-1}. After the solute is dissolved the temperature of the solution will be

(a) 293 K
(b) 298 K
(c) 301 K
(d) 304 K

11. 4 moles each of SO_2 and O_2 gases are allowed to react to form SO_3 in a closed vessel. At equilibrium 25% of O_2 is used up. The total number of moles of all the gases at equilibrium is

(a) 6.5
(b) 7.0
(c) 8.0
(d) 2.0

12. An example for autocatalysis is

(a) oxidation of NO to NO_2
(b) oxidation of SO_2 to SO_3
(c) decomposition of $KClO_3$ to KCl and O_2
(d) oxidation of oxalic acid by acidified $KMnO_4$

13. During the fusion of an organic compound with sodium metal, nitrogen of the compound is converted into

(a) $NaNO_2$
(b) $NaNH_2$
(c) NaCN
(d) NaNC

14. Identify the product Y in the following reaction sequence

$$\begin{array}{c} CH_2 - CH_2 - COO \\ | \\ CH_2 - CH_2 - COO \end{array} Ca \xrightarrow{\text{Heat}} X \xrightarrow[\text{HCl, heat}]{\text{Zn-Hg}} Y$$
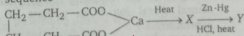
(a) pentane
(b) cyclobutane
(c) cyclopentane
(d) cyclopentanone

15. The reaction $C_2H_5ONa + C_2H_5I \longrightarrow$
    $C_2H_5OC_2H_5 + NaI$ is known as
    (a) Kolbe's synthesis
    (b) Wurtz's synthesis
    (c) Williamson's synthesis
    (d) Grignard's synthesis

16. Glucose contains in addition to aldehyde group
    (a) one secondary OH and four primary OH groups
    (b) one primary OH and four secondary OH groups
    (c) two primary OH and three secondary OH groups
    (d) three primary OH and two secondary OH groups

17. Which of the following taking place in the blast furnace is endothermic ?
    (a) $CaCO_3 \longrightarrow CaO + CO_2$
    (b) $2C + O_2 \longrightarrow 2CO$
    (c) $C + O_2 \longrightarrow CO_2$
    (d) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

18. The formula mass of Mohr's salt is 392. The iron present in it is oxidised by $KMnO_4$ in acid medium. The equivalent mass of Mohr's salt is
    (a) 392   (b) 31.6
    (c) 278   (d) 156

19. Which of the following solutions will exhibit highest boiling point ?
    (a) 0.01 M $Na_2SO_4(aq)$
    (b) 0.01 M $KNO_3(aq)$
    (c) 0.015 M $NaCl(aq)$
    (d) 0.015 M glucose (aq)

20. The highest magnetic moment is shown by the transition metal ion with the configuration
    (a) $3d^2$ (b) $3d^5$
    (c) $3d^7$ (d) $3d^9$

21. A transition metal ion exists in its highest oxidation state. It is expected to behave as
    (a) a chelating agent
    (b) a central metal in a coordination compound
    (c) an oxidising agent
    (d) a reducing agent

22. In which of the following complex ion, the central metal ion is in a state of sp^3d^2 hybridisation ?
    (a) $[CoF_6]^{3-}$ (b) $[Co(NH_3)_6]^{3+}$
    (c) $[Fe(CN)_6]^{3-}$ (d) $[Cr(NH_3)_6]^{3+}$

23. Which of the following can participate in linkage isomerism ?
    (a) NO_2^-
    (b) $H_2NCH_2CH_2\overset{..}{N}H_2$
    (c) H_2O
    (d) $\overset{..}{:}NH_3$

24. Which of the following has the highest bond order ?
    (a) N_2 (b) O_2
    (c) He_2 (d) H_2

25. Which of the following is diamagnetic ?
    (a) H_2^+ (b) O_2
    (c) Li_2 (d) He_2^+

26. The concentration of a reactant X decreases from 0.1 M to 0.005 M in 40 min. If the reaction follows first order kinetics, the rate of the reaction when the concentration of X is 0.01 M will be
    (a) 1.73×10^{-4} M min^{-1}
    (b) 3.47×10^{-4} M min^{-1}
    (c) 3.47×10^{-5} M min^{-1}
    (d) 7.5×10^{-4} M min^{-1}

27. Chemical reactions with very high E_a values are generally
    (a) very fast   (b) very slow
    (c) moderately fast   (d) spontaneous

28. Which of the following does not conduct electricity ?
    (a) Fused NaCl
    (b) Solid NaCl
    (c) Brine solution
    (d) Copper

29. When a quantity of electricity is passed through $CuSO_4$ solution, 0.16 g of copper gets deposited. If the same quantity of electricity is passed through 'acidulated water, then the volume of H_2 liberated at STP will be
    [given : atomic weight of Cu = 64]
    (a) 4.0 cc   (b) 56 cc
    (c) 604 cc   (d) 8.0 cc

30. Solubility product of a salt AB is 1×10^{-8} M^2 in a solution in which the concentration of A^+ ions is 10^{-3} M. The salt will precipitate when the concentration of B^- ions is kept
    (a) between 10^{-8} M to 10^{-7} M
    (b) between 10^{-7} M to 10^{-8} M
    (c) $> 10^{-5}$ M
    (d) $< 10^{-8}$ M

31. Which one of the following conditions will increase the voltage of the cell represented by the equation ?

$$Cu(s) + 2Ag^+(aq) \rightleftharpoons Cu^{2+}(aq) + 2Ag(s)$$

(a) Increase in the dimension of Cu electrode
(b) Increase in the dimension of Ag electrode
(c) Increase in the concentration of Cu^{2+} ions
(d) Increase in the concentration of Ag^+ ions

32. The pH of 10^{-8} M HCl solution is
(a) 8
(b) more than 8
(c) between 6 and 7
(d) slightly more than 7

33. The mass of glucose that should be dissolved in 50 g of water in order to produce the same lowering of pressure as is produced by dissolving 1 g of urea in the same quantity of water is
(a) 1 g
(b) 3 g
(c) 6 g
(d) 18 g

34. Osmotic pressure observed when benzoic acid is dissolved in benzene is less than that expected from theoretical considerations. This is because
(a) benzoic acid is an organic solute
(b) benzoic acid has higher molar mass than benzene
(c) benzoic acid gets associated in benzene
(d) benzoic acid gets dissociated in benzene

35. For a reaction to be spontaneous at all temperatures
(a) ΔG and ΔH should be negative
(b) ΔG and ΔH should be positive
(c) $\Delta G = \Delta S = 0$
(d) $\Delta H < \Delta G$

36. Which of the following electrolyte will have maximum flocculation value for Fe(OH)$_3$ sol ?
(a) NaCl
(b) Na$_2$S
(c) (NH$_4$)$_3$PO$_4$
(d) K$_2$SO$_4$

37. For a reversible reaction
$$X(g) + 3Y(g) \rightleftharpoons 2Z(g); \quad \Delta H = -40 \text{ kJ, the}$$
standard entropies of X, Y and Z are 60, 40 and 50 JK^{-1}mol^{-1} respectively. The temperature at which the above reaction attains equilibrium is about
(a) 400 K
(b) 500 K
(c) 273 K
(d) 373 K

38. The radii of Na$^+$ and Cl$^-$ ions are 95 pm and 181 pm respectively. The edge length of NaCl unit cell is

(a) 276 pm
(b) 138 pm
(c) 552 pm
(d) 415 pm

39. Inductive effect involves
(a) displacement of σ-electrons
(b) delocalisation of π-electrons
(c) delocalisation of σ-electrons
(d) displacement of π-electrons

40. The basicity of aniline is less than that of cyclohexylamine. This is due to
(a) +R effect of —NH$_2$ group
(b) –I effect of —NH$_2$ group
(c) –R effect of —NH$_2$ group
(d) hyperconjugation effect

41. Methyl bromide is converted into ethane by heating it in other medium with
(a) Al
(b) Zn
(c) Na
(d) Cu

42. Which of the following compound is expected to be optically active ?
(a) (CH$_3$)$_2$CHCHO
(b) CH$_3$CH$_2$CH$_2$CHO
(c) CH$_3$CH$_2$CHBrCHO
(d) CH$_3$CH$_2$CBr$_2$CHO

43. Which cycloalkane has the lowest heat of combustion per CH$_2$ group ?
(a) Cyclopropane
(b) Cyclobutane
(c) Cyclopentane
(d) Cyclohexane

44. The catalyst used in the preparation of an alkyl chloride by the action of dry HCl on an alcohol is
(a) anhydrous AlCl$_3$
(b) FeCl$_3$
(c) anhydrous ZnCl$_2$
(d) Cu

45. In the reaction,
$$R-X \xrightarrow{\text{Alcoholic KCN}} A \xrightarrow{\text{Dilute HCl}} B$$
The product B is
(a) alkyl chloride
(b) aldehyde
(c) carboxylic acid
(d) ketone

46. Which of the following compound would not evolve CO_2 when treated with NaHCO$_3$ solution ?
(a) Salicylic acid
(b) Phenol
(c) Benzoic acid
(d) 4-nitrobenzoic acid

47. By heating phenol with chloroform in alkali, it is converted into
(a) salicylic acid
(b) salicylaldehyde
(c) anisole
(d) phenyl benzoate

When a mixture of calcium benzoate and calcium acetate is dry distilled, the resulting compound is

(a) acetophenone   (b) benzaldehyde

(c) benzophenone   (d) acetaldehyde

. Which one of the following does not give benzoic acid on hydrolysis ?

(a) Phenyl cyanide   (b) Benzoyl chloride

(c) Benzyl chloride   (d) Methyl benzoate

50. Which of the following would undergo Hofmann reaction to give a primary amine ?

(a) $R - \overset{\overset{\displaystyle O}{||}}{C} - Cl$ (b) $RCONHCH_3$

(c) $RCONH_2$ (d) $RCOOR$

Mathematics

. If $(p \wedge \sim r) \rightarrow (\sim p \vee q)$ is false, then the truth values of p, q and r are respectively

(a) T, F and F   (b) F, F and T

(c) F, T and T   (d) T, F and T

2. If α, β and γ are the roots of equation $x^3 - 8x + 8 = 0$, then $\Sigma \alpha^2$ and $\Sigma \dfrac{1}{\alpha \beta}$ are respectively

(a) 0 and -16 (b) 16 and 8

(c) -16 and 0   (d) 16 and 0

3. The GCD of 1080 and 675 is

(a) 145   (b) 135

(c) 225   (d) 125

4. If a, b and $c \in N$, then which one of the following is not true ?

(a) $a \,|\, b$ and $a \,|\, c \Rightarrow a \,|\, 3b + 2c$

(b) $a \,|\, b$ and $b \,|\, c \Rightarrow a \,|\, c$

(c) $a \,|\, (b + c) \Rightarrow a \,|\, b$ and $a \,|\, c$

(d) $a \,|\, b$ and $a \,|\, c \Rightarrow a \,|\, b + c$

5. $x = 4(1 + \cos \theta)$ and $y = 3(1 + \sin \theta)$ are the parametric equations of

(a) $\dfrac{(x-3)^2}{9} + \dfrac{(y-4)^2}{16} = 1$

(b) $\dfrac{(x+4)^2}{16} + \dfrac{(y+3)^2}{9} = 1$

(c) $\dfrac{(x-4)^2}{16} - \dfrac{(y-3)^2}{9} = 1$

(d) $\dfrac{(x-4)^2}{16} + \dfrac{(y-3)^2}{9} = 1$

6. If the distance between the foci and the distance between the directrices of the hyperbola $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$ are in the ratio 3 : 2, then $a : b$ is

(a) $\sqrt{2} : 1$

(b) $\sqrt{3} : \sqrt{2}$

(c) $1 : 2$

(d) $2 : 1$

7. The ellipse $\dfrac{x^2}{25} + \dfrac{y^2}{16} = 1$ and the hyperbola $\dfrac{x^2}{25} - \dfrac{y^2}{16} = 1$ have in common

(a) centre only

(b) centre, foci and directrices

(c) centre, foci and vertices

(d) centre and vertices only

8. If $\sec \theta = m$ and $\tan \theta = n$, then $\dfrac{1}{m}\left[(m+n) + \dfrac{1}{(m+n)}\right]$ is

(a) 2   (b) $2m$

(c) $2n$ (d) mn

9. The value of $\dfrac{\sin 85° - \sin 35°}{\cos 65°}$ is

(a) 2   (b) -1

(c) 1   (d) 0

10. If the length of the tangent from any point on the circle $(x - 3)^2 + (y + 2)^2 = 5r^2$ to the circle $(x - 3)^2 + (y + 2)^2 = r^2$ is 16 unit, then the area between the two circles in sq unit is

(a) 32π (b) 4π

(c) 8π (d) 256π

11. The equation of the common tangent of the two touching circles, $y^2 + x^2 - 6x - 12y + 37 = 0$ and $x^2 + y^2 - 6y + 7 = 0$ is

(a) $x + y - 5 = 0$ (b) $x - y + 5 = 0$

(c) $x - y - 5 = 0$ (d) $x + y + 5 = 0$

12. The equation of the parabola with vertex at $(-1, 1)$ and focus $(2, 1)$ is

(a) $y^2 - 2y - 12x - 11 = 0$

(b) $x^2 - 2x - 12y + 13 = 0$

(c) $y^2 - 2y + 12x + 11 = 0$

(d) $y^2 - 2y - 12x + 13 = 0$

3. The equation of the line which is tangent to both the circle $x^2 + y^2 = 5$ and the parabola $y^2 = 40x$ is

(a) $2x - y \pm 5 = 0$
(b) $2x - y + 5 = 0$
(c) $2x - y - 5 = 0$
(d) $2x + y + 5 = 0$

4. If $2A + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 4 \end{bmatrix}$ and

$A + 2B = \begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix}$, then B is

(a) $\begin{bmatrix} 8 & -1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$
(b) $\begin{bmatrix} 8 & 1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$
(c) $\begin{bmatrix} 8 & 1 & -2 \\ -1 & 10 & -1 \end{bmatrix}$
(d) $\begin{bmatrix} 8 & 1 & 2 \\ 1 & 10 & 1 \end{bmatrix}$

5. If $A = \begin{bmatrix} 1 & -3 \\ 2 & k \end{bmatrix}$ and $A^2 - 4A + 10I = A$, then k is equal to

(a) 0
(b) -4
(c) 4 and not 1
(d) 1 or 4

6. The value of $\begin{vmatrix} x+y & y+z & z+x \\ x & y & z \\ x-z & y-z & z-x \end{vmatrix}$ is equal to

(a) $2(x + y + z)^2$
(b) $2(x + y + z)^3$
(c) $(x + y + z)^3$
(d) 0

7. On the set Q of all rational numbers the operation * which is both associative and commutative is given by $a* b$, is

(a) $a + b + ab$
(b) $a^2 + b^2$
(c) $ab + 1$
(d) $2a + 3b$

8. From an aeroplane flying, vertically above a horizontal road, the angles of depression of two consecutive stopes on the same side of the aeroplane are observed to be $30°$ and $60°$ respectively. The height at which the aeroplane is flying in km is

(a) $\dfrac{4}{\sqrt{3}}$
(b) $\dfrac{\sqrt{3}}{2}$
(c) $\dfrac{2}{\sqrt{3}}$
(d) 2

9. If the angles of a triangle are in the ratio $3 : 4 : 5$, then the sides are in the ratio

(a) $2 : \sqrt{6} : \sqrt{3} + 1$
(b) $\sqrt{2} : \sqrt{6} : \sqrt{3} + 1$
(c) $2 : \sqrt{3} : \sqrt{3} + 1$
(d) $3 : 4 : 5$

0. If $\cos^{-1} x = \alpha$, $(0 < x < 1)$ and $\sin^{-1}\left(2x\sqrt{1-x^2}\right) + \sec^{-1}\left(\dfrac{1}{2x^2-1}\right) = \dfrac{2\pi}{3}$, than $\tan^{-1}(2x)$ equals

(a) $\dfrac{\pi}{6}$
(b) $\dfrac{\pi}{4}$
(c) $\dfrac{\pi}{3}$
(d) $\dfrac{\pi}{2}$

21. If $a > b > 0$, then the value of $\tan^{-1}\left(\dfrac{a}{b}\right) + \tan^{-1}\left(\dfrac{a+b}{a-b}\right)$ depends on

(a) both a and b
(b) b and not a
(c) a and not b
(d) neither a nor b

22. If $A = \{a, b, c\}$, $B = \{b, c, d\}$ and $C = \{a, d, c\}$, then $(A - B) \times (B \cap C)$ is equal to

(a) $\{(a, c), (a, d)\}$
(b) $\{(a, b), (c, d)\}$
(c) $\{(c, a), (d, a)\}$
(d) $\{(a, c), (a, d), (b, d)\}$

23. The function $f : X \to Y$ defined by $f(x) = \sin x$ is one-one but not onto, if X and Y are respectively equal to

(a) R and R
(b) $[0, \pi]$ and $[0, 1]$
(c) $\left[0, \dfrac{\pi}{2}\right]$ and $[-1, 1]$
(d) $\left[\dfrac{-\pi}{2}, \dfrac{\pi}{2}\right]$ and $[-1, 1]$

24. If $\log_4 2 + \log_4 4 + \log_4 x + \log_4 16 = 6$, then value of x is

(a) 64
(b) 4
(c) 8
(d) 32

25. If $S_n = \dfrac{1}{6 \cdot 11} + \dfrac{1}{11 \cdot 16} + \dfrac{1}{16 \cdot 21} + \dots$ to n terms, then $6S_n$ equals

(a) $\dfrac{5n - 4}{5n + 6}$
(b) $\dfrac{n}{(5n + 6)}$
(c) $\dfrac{2n - 1}{5n + 6}$
(d) $\dfrac{1}{(5n + 6)}$

26. The remainder obtained when $(1!)^2 + (2!)^2 + (3!)^2 + \dots + (100!)^2$ is divided by 10^2 is

(a) 27
(b) 28
(c) 17
(d) 14

27. In the group $G = \{1, 5, 7, 11\}$ under multiplication modulo 12, the solution of $7^{-1} \otimes_{12} (x \otimes_{12} 11) = 5$ is equals

(a) 5
(b) 1
(c) 7
(d) 11

28. A subset of the additive group of real numbers which is not a subgroup is

(a) $(\{0\}, +)$
(b) $(Z, +)$
(c) $(N, +)$
(d) $(Q, +)$

29. If $\vec{p} = \hat{i} + \hat{j}$, $\vec{q} = 4\hat{k} - \hat{j}$ and $\vec{r} = \hat{i} + \hat{k}$, then the unit vector in the direction of $3\vec{p} + \vec{q} - 2\vec{r}$ is

(a) $\frac{1}{3}(\hat{i} + 2\hat{j} + 2\hat{k})$

(b) $\frac{1}{3}(\hat{i} - 2\hat{j} - 2\hat{k})$

(c) $\frac{1}{3}(\hat{i} - 2\hat{j} + 2\hat{k})$

(d) $\hat{i} + 2\hat{j} + 2\hat{k}$

30. If $\vec{a}$ and $\vec{b}$ are the two vectors such that $|\vec{a}| = 3\sqrt{3}$, $|\vec{b}| = 4$ and $|\vec{a} + \vec{b}| = \sqrt{7}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(a) $120°$ (b) $60°$
(c) $30°$ (d) $150°$

31. If $\vec{a}$ is vector perpendicular to both $\vec{b}$ and $\vec{c}$, then

(a) $\vec{a} + (\vec{b} + \vec{c}) = \vec{0}$

(b) $\vec{a} \times (\vec{b} + \vec{c}) = \vec{0}$

(c) $\vec{a} \times (\vec{b} \times \vec{c}) = \vec{0}$

(d) $\vec{a} \cdot (\vec{b} \times \vec{c}) = \vec{0}$

32. If the area of the parallelogram with $\vec{a}$ and $\vec{b}$ as two adjacent sides is 15 sq unit, then the area of the parallelogram having, $3\vec{a} + 2\vec{b}$ and $\vec{a} + 3\vec{b}$ as two adjacent sides in sq unit is

(a) 120   (b) 105
(c) 75   (d) 45

33. If the lines $x + 3y - 9 = 0$, $4x + by - 2 = 0$ and $2x - y - 4 = 0$ are concurrent, then b equals

(a) -5 (b) 5
(c) 1   (d) 0

34. The equation of the circle having $x - y - 2 = 0$ and $x - y + 2 = 0$ as two tangents and $x - y = 0$ as a diameter is

(a) $x^2 + y^2 + 2x - 2y + 1 = 0$

(b) $x^2 + y^2 - 2x + 2y - 1 = 0$

(c) $x^2 + y^2 = 2$

(d) $x^2 + y^2 = 1$

35. A circular sector of perimeter 60 m with maximum area is to be constructed. The radius of the circular arc in metre must be

(a) 20   (b) 5
(c) 15   (d) 10

36. $\int \frac{(x^3 + 3x^2 + 3x + 1)}{(x + 1)^5} \, dx$ is equal to

(a) $-\frac{1}{(x + 1)} + c$ (b) $\frac{1}{5}\log(x + 1) + c$

(c) $\log(x + 1) + c$ (d) $\tan^{-1} x + c$

37. $\int \frac{\csc x}{\cos^2\left(1 + \log\tan\frac{x}{2}\right)} \, dx$ is equal to

(a) $\sin^2\left[1 + \log\tan\frac{x}{2}\right] + c$

(b) $\tan\left[1 + \log\tan\frac{x}{2}\right] + c$

(c) $\sec^2\left[1 + \log\tan\frac{x}{2}\right] + c$

(d) $-\tan\left[1 + \log\tan\frac{x}{2}\right] + c$

38. The complex number $\frac{(-\sqrt{3} + 3i)(1 - i)}{(3 + \sqrt{3}i)(i)(\sqrt{3} + \sqrt{3}i)}$ when represented in the Argand diagram is

(a) in the second quadrant

(b) in the first quadrant

(c) on the y-axis (imaginary axis)

(d) on the x-axis (real axis)

39. If $2x = -1 + \sqrt{3}i$, then the value of $(1 - x^2 + x)^6 - (1 - x + x^2)^6$ is equal to

(a) 32   (b) -64
(c) 64   (d) 0

40. The modulus and amplitude of $(1 + i\sqrt{3})^8$ are respectively

(a) 256 and $\frac{\pi}{3}$ (b) 256 and $\frac{2\pi}{3}$

(c) 2 and $\frac{2\pi}{3}$ (d) 256 and $\frac{8\pi}{3}$

41. The value of $\lim_{x \to 0} \frac{5^x - 5^{-x}}{2x}$ is

(a) log 5   (b) 0
(c) 1   (d) 2 log 5

42. Which one of the following is not true always ?

(a) If $f(x)$ is not continuous at $x = a$, then it is not differentiable at $x = a$

(b) If $f(x)$ is continuous at $x = a$, then it is differentiable at $x = a$

(c) If $f(x)$ and $g(x)$ are differentiable at $x = a$, then $f(x) + g(x)$ is also differentiable at $x = a$

(d) If a function $f(x)$ is continuous at $x = a$, then $\lim_{x \to a} f(x)$ exists

43. $\int \dfrac{dx}{x\sqrt{x^6-16}}$ is equal to

(a) $\dfrac{1}{3}\sec^{-1}\left(\dfrac{x^3}{4}\right)+c$ (b) $\cosh^{-1}\left(\dfrac{x^3}{4}\right)+c$

(c) $\dfrac{1}{12}\sec^{-1}\left(\dfrac{x^3}{4}\right)+c$ (d) $\sec^{-1}\left(\dfrac{x^3}{4}\right)+c$

44. If $I_1=\int_0^{\pi/2} x \sin x\,dx$ and $I_2=\int_0^{\pi/2} x \cos x\,dx$,

then which one of the following is true ?

(a) $I_1+I_2=\dfrac{\pi}{2}$ (b) $I_2-I_1=\dfrac{\pi}{2}$

(c) $I_1+I_2=0$ (d) $I_1=I_2$

45. If $f(x)$ is defined $[-2, 2]$ by $f(x)=4x^2-3x+1$ and $g(x)=\dfrac{f(-x)-f(x)}{x^2+3}$,

then $\int_{-2}^{2} g(x)\,dx$ is equal to

(a) 64   (b) –48

(c) 0   (d) 24

46. The area enclosed between the parabola $y=x^2-x+2$ and the line $y=x+2$ in sq unit equals

(a) $\dfrac{8}{3}$ (b) $\dfrac{1}{3}$

(c) $\dfrac{2}{3}$ (d) $\dfrac{4}{3}$

47. The solution of the differential equation $e^{-x}(y+1)\,dy+(\cos^2 x+\sin 2x)y\,dx=0$ subjected to the condition that $y=1$ when $x=0$ is

(a) $y+\log y+e^x\cos^2 x=c$

(b) $\log(y+1)+e^x\cos^2 x=1$

(c) $y+\log y=e^x\cos^2 x$

(d) $(y+1)+e^x\cos^2 x=2$

48. If the curve $y=2x^3+ax^2+bx+c$ passes through the origin and the tangents drawn to it at $x=-1$ and $x=2$ are parallel to the x-axis, then the values of a, b and c are respectively

(a) 12, –3 and 0   (b) –3, –12 and 0

(c) –3, 12 and 0   (d) 3, –12 and 0

49. The locus of the point which moves such that the ratio of its distance from two fixed point in the plane is always a constant $k\,(<1)$ is

(a) hyperbola   (b) ellipse

(c) straight line   (d) circle

50. The circles $ax^2+ay^2+2g_1 x+2f_1 y+c_1=0$ and $bx^2+by^2+2g_2 x+2f_2 y+c_2=0$ $(a\neq 0$ and $b\neq 0)$ cut orthogonally if

(a) $g_1 g_2+f_1 f_2=ac_1+bc_2$

(b) $2(g_1 g_2+f_1 f_2)=bc_1+ac_2$

(c) $bg_1 g_2+af_1 f_2=bc_1+ac_2$

(d) $g_1 g_2+f_1 f_2=c_1+c_2$

Answers

➡ **PHYSICS**

1. (c)	2. (c)	3. (d)	4. (d)	5. (c)	6. (d)	7. (a)	8. (d)	9. (c)	10. (a)
11. (b)	12. (c)	13. (c)	14. (b)	15. (c)	16. (d)	17. (a)	18. (b)	19. (a)	20. (b)
21. (c)	22. (a)	23. (c)	24. (c)	25. (d)	26. (c)	27. (a)	28. (c)	29. (a)	30. (c)
31. (d)	32. (c)	33. (b)	34. (c)	35. (c)	36. (a)	37. (a)	38. (b)	39. (b)	40. (d)
41. (a)	42. (d)	43. (a)	44. (c)	45. (b)	46. (c)	47. (c)	48. (d)	49. (a)	50. (d)

➡ **CHEMISTRY**

1. (a)	2. (a)	3. (b)	4. (a)	5. (c)	6. (a)	7. (c)	8. (b)	9. (c)	10. (a)
11. (a)	12. (d)	13. (c)	14. (c)	15. (c)	16. (b)	17. (a)	18. (a)	19. (a)	20. (b)
21. (c)	22. (a)	23. (a)	24. (c)	25. (c)	26. (d)	27. (b)	28. (b)	29. (b)	30. (c)
31. (d)	32. (c)	33. (b)	34. (c)	35. (a)	36. (a)	37. (b)	38. (c)	39. (a)	40. (a)
41. (c)	42. (c)	43. (d)	44. (b)	45. (c)	46. (b)	47. (b)	48. (a)	49. (c)	50. (c)

➡ **MATHEMATICS**

1. (a)	2. (d)	3. (b)	4. (c)	5. (d)	6. (a)	7. (a)	8. (a)	9. (c)	10. (a)
11. (c)	12. (a)	13. (a)	14. (b)	15. (c)	16. (d)	17. (a)	18. (b)	19. (a)	20. (c)
21. (d)	22. (a)	23. (c)	24. (d)	25. (b)	26. (c)	27. (b)	38. (c)	39. (b)	40. (b)
31. (c)	32. (b)	33. (a)	34. (c)	35. (c)	36. (d)	47. (a)	48. (b)	49. (b)	50. (b)
41. (a)	42. (b)	43. (c)	44. (b)	45. (c)					