Solved Paper 2006

# INDRAPRASTHA CET
Engineering Entrance Exam

> Physics

1. If M is the mass of the earth and R its radius, the ratio of the gravitational acceleration and the gravitational constant is :
   (a) $\dfrac{R^2}{M}$
   (b) $\dfrac{M}{R^2}$
   (c) MR^2
   (d) $\dfrac{M}{R}$

2. A student unable to answer a question on Newton's laws of motion attempts to pull himself up by tugging on the his hair. He will not succeed :
   (a) as the force exerted is small
   (b) the frictional force while gripping, is small
   (c) Newton's law of inertia is not applicable to living beings
   (d) as the force applied is internal to the system

3. From the adjacent figure, the correct observation is :
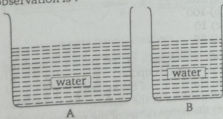
   (a) the pressure on the bottom of tank A is greater than at the bottom of B
   (b) the pressure on the bottom of the tank A is smaller than at the bottom of B
   (c) the pressure depends on the shape of the container
   (d) the pressure on the bottom of A and B is the same

4. Which one of the following is not a unit of Young's modulus ?
   (a) NM^{-1}
   (b) NM^{-2}
   (c) dyne cm^{-2}
   (d) mega pascal

5. A piece of blue glass heated to a high temperature and a piece of red grass at room temperature, are taken inside a dimly lit room, then :
   (a) the blue piece will look blue and red will look as usual
   (b) red looks brighter red and blue looks ordinary blue
   (c) blue shines like brighter red compared to the red piece
   (d) both the pieces will look equally red

6. Three long, straight parallel wires, carrying current, are arranged as shown in figure. The force experienced by a 25 cm length of wire C is :
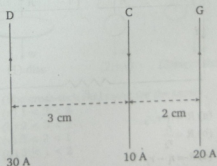

   (a) 10^{-3} N
   (b) 2.5×10^{-3} N
   (c) zero
   (d) 1.5×10^{3} N

7. A 5.0 amp current is setup in an external circuit by a 6.0 volt storage battery for 6.0 minutes. The chemical energy of the battery is reduced by :
   (a) 1.08×10^4 J
   (b) 1.08×10^4 J
   (c) 1.8×10^4 J
   (d) 1.08×10^4 J

8. The current in a simple series circuit is 5.0 A. When an additional resistance of 2.0Ω is inserted, the current drops to 4.0 A. The original resistance of the circuit in ohms was :
   (a) 1.25
   (b) 8
   (c) 10
   (d) 20

9. In the circuit given $E = 6.0$ V, $R_1 = 100 \Omega$, $R_4 = 75 \Omega$. The equivalent resistance of the circuit, in ohms, is :
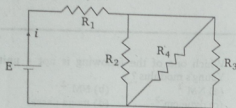

   (a) 11.875
   (b) 26.31
   (c) 118.75
   (d) none of these

10. Two resistances are connected in two gaps of a metre bridge. The balance point is 20 cm from the zero end. A resistance of 15Ω is connected in series with the smaller of the two. The null point shifts to 40 cm. The value of the smaller resistance in ohms is :
    (a) 3
    (b) 6
    (c) 9
    (d) 12

11. If the potential difference across the internal resistance r_i is equal to the emf E of the battery, then :
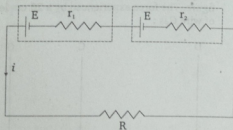

    (a) $R = r_1 + r_2$
    (b) $R = \dfrac{r_1}{r_2}$
    (c) $R = r_1 - r_2$
    (d) $R = \dfrac{r_2}{r_1}$

12. By using only two resistance coils-singly, in series or in parallel one should be able to obtain resistances of 3, 4, 12 and 16Ω. The separate resistance of the coil are :
    (a) 3 and 4
    (b) 4 and 12
    (c) 12 and 16
    (d) 16 and 3

13. The electrons in the beam of a television tube move horizontally from south to north. The vertical component of the earth's magnetic field points down. The electron is deflected towards :
    (a) west
    (b) no deflection
    (c) east
    (d) north to south

14. A tangent galvanometer has a reduction factor of 1 A and it is placed with the plane of its coil perpendicular to the magnetic meridian. The deflection produced when a current of 1 A is passed through it is :
    (a) 60°
    (b) 45°
    (c) 30°
    (d) none of the above

15. In the given circuit, the voltmeter records 5 V. The resistance of the voltmeter in ohms is :
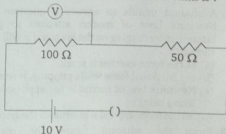
    (a) 200
    (b) 100
    (c) 10
   (d) 50

16. The wavelength of the radiation emitted by a body depends upon :
    (a) the nature of the surface
    (b) the area of the surface
    (c) the temperature of the surface
    (d) all of the above factors

17. Which mirror is to be used to obtain a parallel beam of light from a small lamp ?
    (a) Plane mirror
    (b) Convex mirror
    (c) Concave mirror
    (d) Any one of the above

18. An ideal monoatomic gas is taken around the cycle $ABCDA$ as shown in the PV diagram. The work done during the cycle is given by :
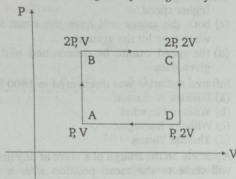
(a) $\frac{1}{2}PV$ (b) PV

(c) $2PV$ (d) $4PV$

19. Which of the following is a wrong statement ?
   (a) $D = \frac{1}{f}$, where f is the focal length and D is called the refractive power of a lens
   (b) Power is expressed in dioptre when f is in metres
   (c) Power is expressed in dioptre and does not depend on the system of unit used to measure f
   (d) D is positive for convergent lens and negative for divergent lens

20. Identify the wrong description of the below figures :
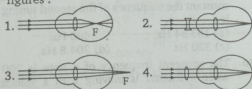
   (a) 1 represents far-sightedness
   (b) 2 correction for short sightedness
   (c) 3 represents far-sightedness
   (d) 4 correction for far-sightedness

21. An electric field of 1500 V/m and a magnetic field of 0.40 Wb/m^2 act on a moving electron. The minimum uniform speed along a straight line the electron could have is :
   (a) 1.6×10^{15} m/s
   (b) 6×10^{-16} m/s
   (c) 3.75×10^3 m/s
   (d) 3.75×10^2 m/s

22. In an ammeter 10% of main current is passing through the galvanometer. If the resistance of the galvanometer is C, then the shunt resistance, in ohms is :
   (a) $9G$
   (b) $\frac{G}{9}$
   (c) $90G$
   (d) $\frac{G}{90}$

23. Among the following properties describing diamagnetism identify the property that is wrongly stated :
   (a) diamagnetic material do not have permanent magnetic moment
   (b) diamagnetism is explained in terms of electromagnetic induction
   (c) diamagnetic materials have a small positive susceptibility
   (d) the magnetic moment of individual electrons neutralize each other

24. The induction coil works on the principle of :
   (a) self-induction
   (b) mutual induction
   (c) Ampere's rule
   (d) Fleming's right hand rule

25. The square root of the product of inductance and capacitance has the dimension of :
   (a) length
   (b) mass
   (c) time
   (d) no dimension

26. When a body falls in air, the resistance of air depends to a great extent on the shape of the body. 3 different shapes are given. Identify the combination of air resistances which truly represents the physical situation.


(1) disc (2) ball (3) cigar shaped
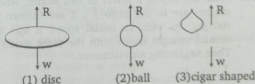
(The cross-sectional areas are the same).
   (a) $1 < 2 < 3$
   (b) $2 < 3 < 1$
   (c) $3 < 2 < 1$
   (d) $3 < 1 < 2$

The adjacent figure is the part of a horizontally stretched net. Section AB is stretched with a force of 10 N. The tensions in the sections BC and BF are :
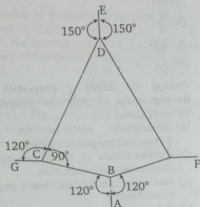
(a) 10 N, 11 N
(b) 10 N, 6 N
(c) 10 N, 10 N
(d) cannot be calculated due to insufficient data

28. Out of the following four dimensional quantities, which one qualifies to be called a dimensional constant ?
(a) Acceleration due to gravity
(b) Surface tension of water
(c) Weight of a standard kilogram mass
(d) The velocity of light in vacuum

29. The relationship between the force F and position x of a body is as shown in figure. The work done in displacing the body from $x = 1$ m to $x = 5$ m will be :
(a) 30 J
(b) 15 J
(c) 25 J
(d) 20 J

30. From the top of a tower of two stones, whose masses are in the ratio 1 : 2 are thrown up with an initial speed u and the second straight down with the same speed u. Then neglecting air resistance :
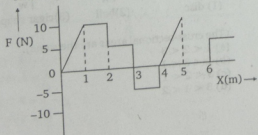

(a) the heavier stone hits the ground with a higher speed
(b) the lighter stone hits the ground with a higher speed
(c) both the stones will have the same speed when they hit the ground
(d) the stone cannot be determined with the given data

31. Infrared radiation was discovered in 1800 by :
(a) William Wollaston
(b) William Herschel
(c) Wilhelm Roentgen
(d) Thomas Young

32. A particle on the trough of a wave at any instant will come to the mean position after a time (T = time period) :
(a) $T/2$
(b) $T/4$
(c) T
(d) $2T$

33. The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm. The emitted sound is in unison with a tuning fork of frequency :
(a) 10 Hz
(b) 360 Hz
(c) 216 Hz
(d) 60 Hz

34. The ratio of velocity of sound in hydrogen and oxygen at STP is :
(a) 16 : 1
(b) 8 : 1
(c) 4 : 1
(d) 2 : 1

35. In an experiment with sonometer a tuning fork of frequency 256 Hz resonates with a length of 25 cm and another tuning fork resonates with a length of 16 cm. Tension of the string remaining constant the frequency of the second tuning fork is :
(a) 163.84 Hz
(b) 400 Hz
(c) 320 Hz
(d) 204.8 Hz

36. The apparent frequency of a note is 200 Hz, when a listener is moving with a velocity of 40 ms^{-1} towards a stationary source. When he moves away from the same source with the same speed, the apparent frequency of the same note is 160 Hz. The velocity of sound in air in m/s is :
(a) 340
(b) 330
(c) 360
(d) 320

37. The wave theory of light, in its original form, was first postulated by :
(a) Isaac Newton
(b) Christian Huygens
(c) Thomas Young
(d) Augustin Jean Fresnel

38. If a liquid does not wet glass, its angle of contact is :

(a) zero   (b) acute
(c) obtuse   (d) right angle

39. The magnitude of i in ampere is :
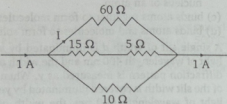
(a) 0.1   (b) 0.3
(c) 0.6   (d) none of these

40. Electron of mass m and charge q is travelling with a speed v along a circular path of radius r at right angles to a uniform magnetic field of intensity B. If the speed of the electron is doubled and the magnetic field is halved the resulting path would have a radius :

(a) $2r$ (b) $4r$
(c) $r/4$ (d) $r/2$

41. From the figure describing photoelectric effect we may infer correctly that :
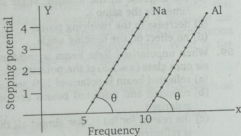
(a) Na and Al both have the same threshold frequency
(b) maximum kinetic energy for both the metals depend linearly on the frequency
(c) the stopping potentials are different for Na and Al for the same change in frequency
(d) Al is a better photo sensitive material than Na

42. Two coherent light beams of intensity I and $4I$ are superposed. The maximum and minimum possible intensities in the resulting beam are :

(a) $9I$ and I (b) $9I$ and $3I$
(c) $5I$ and I (d) $5I$ and $3I$

43. The electron in a hydrogen atom makes a transition from $n = n_1$ to $n = n_2$ state. The time period of the electron in the initial state (n_1) is

eight times that in the final state (n_2). The possible values of n_1 and n_2 are :

(a) $n_1 = 8, n_2 = 1$ (b) $n_1 = 4, n_2 = 2$
(c) $n_1 = 2, n_2 = 4$ (d) $n_1 = 1, n_2 = 8$

44. If the forward voltage in a diode is increased, the width of the depletion region :

(a) increases   (b) decreases
(c) fluctuates   (d) no change

45. Two nucleons are at a separation of one Fermi. Protons have a charge of $+1.6 \times 10^{-19}$ C. The net nuclear force between them is F_1, if both are neutrons, F_2 if both are protons and F_3 if one is proton and the other is neutron. Then :

(a) $F_1 = F_2 > F_3$ (b) $F_1 = F_2 = F_3$
(c) $F_1 < F_2 < F_3$ (d) $F_1 > F_2 > F_3$

46. The electric flux for Gaussian surface A that enclose the charged particles in free space is (given $q_1 = -14$ nC, $q_2 = 78.85$ nC, $q_3 = -56$ nC) :
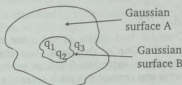
(a) 10^3 Nm^{2}C^{-1}
(b) 10^3 CN^{-1}m^{-2}
(c) 6.32×10^3 Nm^{2}C^{-1}
(d) 6.32×10^3 CN^{-1}m^{-2}

47. Four metal conductors having different shapes :
1. a sphere   2. cylinder
3. pear   4. lightning conductor
are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is

(a) 1   (b) 2   (c) 3   (d) 4

48. The potential to which a conductor is raised, depends on :

(a) the amount of charge
(b) geometry and size of the conductor
(c) both (a) and (b)
(d) only on (a)

49. The work done in carrying a charge q once round a circle of radius r with a charge Q at the centre is :

(a) $\dfrac{qQ}{4\pi\varepsilon_0 r}$ (b) $\dfrac{qQ}{4\pi\varepsilon_0 r^2}$
(c) $\dfrac{qQ}{4\pi\varepsilon_0 r^2}$ (d) none of these

An air filled parallel plate condenser has a capacity of 2 pF. The separation of the plates is doubled and the interspace between the plates is filled with wax. If the capacity is increased to 6 pF, the dielectric constant of wax is :

(a) 2

(b) 3

(c) 4

(d) 6

The energy that should be added to an electron to reduce its de-Broglie wavelength from 1 nm to 0.5 nm is :

(a) four times the initial energy

(b) equal to the initial energy

(c) twice the initial energy

(d) thrice the initial energy

Mean life of a radioactive sample is 100 s. Then, its half-life (in minutes) is :

(a) 0.693

(b) 1

(c) 10^{-4}

(d) 1.155

Consider two nuclei of the same radioactive nuclide. One of the nuclei was created in a supernova explosion 5 billion years ago. The other was created in a nuclear reactor 5 minutes ago. The probability of decay during the next time is :

(a) different for each nuclei

(b) nuclei created in explosion decays first

(c) nuclei created in the reactor decays first

(d) independent of the time of creation

Bohr's atom model assumes :

(a) the nucleus is of infinite mass and is at rest

(b) electrons in a quantized orbit will not radiate energy

(c) mass of electron remains constant

(d) all the above conditions

Identify the property which is not characteristics for a semiconductor ?

(a) At a very low temperatures, it behaves like an insulator

(b) At higher temperatures two types of charge carriers will cause conductivity

(c) The charge carriers are electrons and holes in the valence band at higher temperatures

(d) The semiconductor is electrically neutral

56. Identify the wrong statement in the following, Coulomb's law correctly described the electric force that :

(a) binds the electrons of an atom to its nucleus

(b) binds the protons and neutrons in the nucleus of an atom

(c) binds atoms together to form molecules

(d) binds atoms and molecules to form solids

57. A single slit of width d is illuminated by violet light of wavelength 400 nm and the width of the diffraction pattern is measured as y. When half of the slit width is covered illuminated by yellow light of wavelength 600 nm, the width of the diffraction pattern is :

(a) the pattern vanishes and the width is zero

(b) $\frac{y}{3}$

(c) $3y$

(d) none of the above

58. At Kavalur in India, the astronomers using a telescope whose objective had a diameter of one metre started using telescope of diameter 2.54 m. This resulted in :

(a) the increase in the resolving power by 2.54 times for the same λ

(b) the increase in the limiting angle by 2.54 times for the same λ

(c) decrease in the resolving power

(d) no effect on the limiting angle

59. When unpolarised light beam is incident from air onto glass ($n = 1.5$) at the polarising angle :

(a) reflected beam is polarised 100 per cent

(b) reflected and refracted beams are partially polarised

(c) the reason for (a) is that almost all the light is reflected

(d) all of the above

60. Select the right option in the following :

(a) Christian Huygens, a contemporary of Newton established the wave theory of light by assuming that light waves were transverse

(b) Maxwell provided the theoretical evidence that light is transverse wave

(c) Thomas Young experimentally proved the wave behaviour of light and Huygens assumption

(d) All the statements given above, correctly answers the question "what is light ?"

Chemistry

15 moles of H_2 and 5.2 moles of I_2 are mixed and allowed to attain equilibrium at $500°C$. At equilibrium, the concentration of HI is found to be 10 moles. The equilibrium constant for the formation of HI is :

(a) 50   (b) 15
(c) 100   (d) 25

2. If, in the reaction $N_2O_4 \rightleftharpoons 2NO_2$, x is that part of N_2O_4 which dissociates, then the number of molecules at equilibrium will be :

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

3. Which of these does not influence the rate of reaction ?

(a) Nature of the reactants
(b) Concentration of the reactants
(c) Temperature of the reaction
(d) Molecularity of the reaction

4. For the reaction $A + B \rightarrow C$, it is found that doubling the concentration of A increases the rate by 4 times, and doubling the concentration of B doubles the reaction rate. What is the overall order of the reaction ?

(a) 4   (b) 3/2   (c) 3   (d) 1

5. The rate at which a substance reacts depends on its :

(a) atomic weight   (b) atomic number
(c) molecular weight   (d) active mass

6. A compound A has a molecular formula C_2Cl_3OH. It reduces Fehling's solution and on oxidation, gives a monocarboxylic acid B. A can be obtained by the action of chlorine on ethyl alcohol. A is :

(a) chloroform
(b) chloral
(c) methyl chloride
(d) monochloroacetic acid

7. Which of the following haloalkanes is most reactive ?

(a) 1-chloropropane   (b) 1-bromopropane
(c) 2-chloropropane   (d) 2-bromopropane

8. The reaction in which phenol differs from alcohol is :

(a) it undergoes esterification with carboxylic acid
(b) it reacts with ammonia

(c) it forms yellow crystals of iodoform
(d) it liberates H_2 with Na metal

9. An organic compound A containing C, H and O has a pleasant odour with boiling point of $78°C$. On boiling A with concentrated H_2SO_4, a colourless gas is produced which decolourises bromine water and alkaline $KMnO_4$. The organic liquid A is :

(a) C_2H_4Cl (b) $C_2H_5COOCH_3$
(c) C_2H_5OH (d) C_2H_6

10. Which of the following is an amphoteric acid ?

(a) Glycine   (b) Salicylic acid
(c) Benzoic acid   (d) Citric acid

11. Gold is extracted by hydrometallurgical process, based on its property :

(a) of being electropositive
(b) of being less reactive
(c) to form complexes which are water soluble
(d) to form salts which are water soluble

12. In blast furnace, iron oxide is reduced by :

(a) hot blast of air   (b) carbon monoxide
(c) carbon   (d) silica

13. Which of the following pairs of elements cannot from an alloy ?

(a) Zn, Cu   (b) Fe, Hg
(c) Fe, C   (d) Hg, Na

14. Which compound is zero valent metal complex ?

(a) $[Cu(NH_3)_4]SO_4$ (b) $[Pt(NH_3)_2Cl_2]$
(c) $[Ni(CO)_4]$ (d) $K_3[Fe(CN)_6]$

15. Alum is a water purifier because it :

(a) coagulates the impurities
(b) softens hard water
(c) gives taste
(d) destroys the pathogenic bacteria

16. For the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, the value of K_c at $800°C$ is 0.1. When the equilibrium concentration of both the reactants is 0.5 mol, what is the value of K_p at the same temperature ?

(a) 0.5   (b) 0.1   (c) 0.01   (d) 0.025

17. The extent of adsorption of a gas on a solid depends on :

(a) nature of the gas   (b) pressure of the gas
(c) temperature of the gas
(d) all of the above

18. A emulsifier is a substance which :
(a) stabilises the emulsion
(b) homogenises the emulsion
(c) coagulates the emulsion
(d) accelerates the dispersion of liquid in liquid

19. Which of the following types of metals form the most efficient catalyst ?
(a) Alkali metals
(b) Alkaline earth metals
(c) Transition metals
(d) All of the above

20. The species among the following, which can act as an acid and a base is :
(a) HSO_4^-
(b) SO_4^{2-}
(c) H_3O^+
(d) Cl^-

21. Benzyl alcohol and sodium benzoate is obtained by the action of sodium hydroxide on benzaldehyde. This reaction is known as :
(a) Perkin's reaction
(b) Cannizaro's reaction
(c) Sandmeyer's reaction
(d) Claisen condensation

22. Ethyl chloride on heating with AgCN forms a compound X. The functional isomer of X is :
(a) C_2H_5NC
(b) $C_2H_5NH_2$
(c) C_2H_5CN
(d) none of these

23. A compound, containing only carbon, hydrogen and oxygen, has a molecular weight of 44. On complete oxidation it is converted into a compound of molecular weight 60. The original compound is :
(a) an aldehyde
(b) an acid
(c) an alcohol
(d) an ether

24. Grignard reagent adds to :
(a) $> C = O$
(b) $— C \equiv N$
(c) $> C = S$
(d) all of these

25. Which of the following biomolecules contain non-transition metal ion ?
(a) Vitamin B_{12}
(b) Chlorophyll
(c) Haemoglobin
(d) Insulin

26. A mixture of two moles of carbon monoxide and one mole of oxygen, in a closed vessel is ignited to convert the carbon monoxide to carbon dioxide. If ΔH is the enthalpy change and ΔE is the change in internal energy, then :
(a) $\Delta H > \Delta E$
(b) $\Delta H < \Delta E$
(c) $\Delta H = \Delta E$
(d) the relationship depends on the capacity of the vessel

27. The cooling in refrigerator is due to :
(a) reaction of the refrigerator gas

(b) expansion of ice
(c) the expansion of the gas in the refrigerator
(d) the work of the compressor

28. For a system in equilibrium, $\Delta G = 0$ under conditions of constant :
(a) temperature and pressure
(b) temperature and volume
(c) pressure and volume
(d) energy and volume

29. Molar heat of vaporisation of a liquid is $6 \ kJ \ mol^{-1}$. If the entropy change is $16 \ J \ mol^{-1} \ K^{-1}$, the boiling point of the liquid is :
(a) 375°C
(b) 375 K
(c) 273 K
(d) 102°C

30. The temperature of the system decreases in an :
(a) adiabatic compression
(b) isothermal compression
(c) isothermal expansion
(d) adiabatic expansion

31. A buffer solution has equal volumes of 0.2M NH_4OH and 0.02 M NH_4Cl. The pK_b of the base is 5. The pH is :
(a) 10
(b) 9
(c) 4
(d) 7

32. The hydrogen electrode is dipped in a solution of pH 3 at 25°C. The potential would be (the value of $2.303 \ RT/F$ is 0.059 V) :
(a) 0.177 V
(b) 0.087 V
(c) 0.059 V
(d) – 0.177 V

33. 20 mL of 0.5 N HCl and 35 mL of 0.1 N NaOH are mixed. The resulting solution will :
(a) be neutral
(b) be basic
(c) turn phenolphthalein solution pink
(d) turn methyl orange red

34. Corrosion of iron is essentially an electrochemical phenomenon where the cell reactions are :
(a) Fe is oxidised to Fe^{2+} and dissolved oxygen in water is reduced to OH^-
(b) Fe is oxidised to Fe^{3+} and H_2O is reduced to O_2^{2-}
(c) Fe is oxidised to Fe^{2+} and H_2O is reduced to O_2^-
(d) Fe is oxidised to Fe^{3+} and H_2O is reduced to O_2

35. The standard electrode potential is measured by :
(a) electrometer
(b) voltmeter
(c) pyrometer
(d) galvanometer

A precipitate of AgCl is formed when equal volumes of the following are mixed :

$[K_{sp}$ for AgCl $= 10^{-10}]$:

(a) 10^{-4} M $AgNO_3$ and 10^{-7} M HCl

(b) 10^{-5} M $AgNO_3$ and 10^{-6} M HCl

(c) 10^{-5} M $AgNO_3$ and 10^{-4} M HCl

(d) 10^{-6} M $AgNO_3$ and 10^{-6} M HCl

. Which one of the following defects in the crystals lowers its density ?

(a) Frenkel defect

(b) Schottky defect

(c) F-centres

(d) Interstitial defect

. A radioactive isotope has a half-life of 10 days. If today 125 mg is left over, what was its original weight 40 days earlier ?

(a) 2 g   (b) 600 mg

(c) 1 g   (d) 1.5 g

. Which of the following cannot be accelerated ?

(a) α-particle   (b) β-particle

(c) Protons   (d) Neutrons

. In which of the following nuclear reaction neutrons is emitted ?

(a) $^{27}_{13}Al + ^{4}_{2}He \rightarrow ^{30}_{15}P$

(b) $^{12}_{6}C + ^{1}_{1}H \rightarrow ^{13}_{7}N$

(c) $^{30}_{15}P \rightarrow ^{30}_{14}Si$

(d) $^{241}_{96}Am + ^{4}_{2}He \rightarrow ^{245}_{97}Bk$

1. Molarity of 0.2 N H_2SO_4 is :

(a) 0.2   (b) 0.4

(c) 0.6   (d) 0.1

2. In the equation of state of an ideal gas $PV = nRT$, the value of the universal gas constant would depend only on :

(a) the nature of the gas

(b) the pressure of the gas

(c) the units of the measurement

(d) none of the above

3. A commercial sample of hydrogen peroxide is labelled as 10 volume. Its percentage strength is nearly :

(a) 1%   (b) 3%

(c) 10%   (d) 90%

14. Activated charcoal is used to remove colouring matter from pure substances. It works by :

(a) oxidation   (b) reduction

(c) bleaching   (d) adsorption

45. When plants and animals decay, the organic nitrogen is converted into inorganic nitrogen. The inorganic nitrogen is in the form of :

(a) ammonia

(b) elements of nitrogen

(c) nitrates

(d) nitrides

46. Three dimensional molecules with cross links are fomed in the case of a :

(a) thermoplastic

(b) thermosetting plastic

(c) both (a) and (b)

(d) none of the above

47. Sucrose molecule is made up of :

(a) a gluco-pyranose and a fructo-pyranose

(b) a gluco-pyranose and a fructo-furanose

(c) a gluco-furanose and a fructo-pyranose

(d) a gluco-furansose and a fructo-furanose

48. Water insoluble component of starch is :

(a) amylopectin   (b) amylose

(c) cellulose   (d) none of these

49. An example for a saturated fatty acid, present in nature is :

(a) oleic acid   (b) linoleic acid

(c) linolenic acid   (d) palmitic acid

50. A nanopeptide contains ..... peptide linkages :

(a) 10   (b) 8

(c) 9   (d) 18

51. A gas decolourised by $KMnO_4$ solution but gives no precipitate with ammoniacal cuprous chloride is :

(a) ethane   (b) methane

(c) ethene   (d) acetylene

52. $H_3C - \overset{\displaystyle |}{\underset{\displaystyle Cl}{C}} = CH - CH - CH_3$
$\qquad\qquad\qquad\quad \underset{\displaystyle CH_3}{|}$

(a) 2-chloro-4-methyl-2-pentene

(b) 4-chloro-2-methyl-3-pentene

(c) 4-methyl-2-chloro-2-pentene

(d) 2-chloro-4, 4-dimethyl-2-butene

53. Amongst the following the compound that can most readily get sulphonated is :

(a) benzene   (b) toluene

(c) nitrobenzene   (d) chlorobenzehe

54. Household gaseous fuel (LPG) mainly contains :

(a) CH_4 (b) C_2H_2

(c) C_2H_4 (d) C_4H_{10}

55. Use of chlorofluoro carbons is not encouraged because :

(a) they are harmful to the eyes of people that use it

(b) they damage the refrigerators and air conditioners

(c) they eat away the ozone in the atmosphere

(d) they destroy the oxygen layer

56. An example of a sulphur containing amino acid is :
    (a) lysine   (b) serine
    (c) cysteine   (d) tyrosine

57. Which of the following is not present in a nucleotide ?
    (a) Cytosine   (b) Guanine
    (c) Adenine   (d) Tyrosine

58. Antiseptic chloroxylenol is :
    (a) 4-chloro-3, 5-dimethyl phenol
    (b) 3-chloro-4, 5-dimethyl phenol

(c) 4-chloro-2, 5-dimethyl phenol
(d) 5-chloro-3, 4-dimethyl phenol

59. An atom of an element A has three electrons in its outermost orbit and that of B has six electrons in its outermost orbit. The formula of the compound between these two will be :
    (a) A_3B_6 (b) A_2B_3
    (c) A_3B_2 (d) A_2B

60. Among Na^+, Na, Mg and Mg^{2+}, the largest particle is :
    (a) Mg^{2+} (b) Mg
    (c) Na   (d) Na^+

Mathematics

1. If the regression coefficient of Y on X is 4/3, then the regression coefficient of X on Y :
   (a) is $\frac{3}{4}$ (b) is less than $\frac{3}{4}$
   (c) is less than 1   (d) can take any value

2. Which of the following is the inverse of the proposition. "If a number is a prime then it is odd' ?
   (a) If a number is a prime then it is odd
   (b) If a number is not a prime then it is not odd
   (c) If a number is not odd then it is not a prime
   (d) If a number is odd then it is a prime

3. What must be the matrix X if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$?
   (a) $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$
   (c) $\begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$

4. The value of $\begin{vmatrix} 1 & 1 & 1 \\ bc & ca & ab \\ b+c & c+a & a+b \end{vmatrix}$ is :
   (a) 1
   (b) 0
   (c) $(a-b)(b-c)(c-a)$
   (d) $(a+b)(b+c)(c+a)$

5. The value of $\begin{vmatrix} 441 & 442 & 443 \\ 445 & 446 & 447 \\ 449 & 450 & 451 \end{vmatrix}$ is :
   (a) $441 \times 446 \times 4510$
   (b) 0
   (c) -1
   (d) 1

6. $(\vec{a} \cdot \hat{i}) \hat{i} + (\vec{a} \cdot \hat{j}) \hat{j} + (\vec{a} \cdot \hat{k}) \hat{k}$ is equal to :
   (a) $\vec{a}$ (b) $2\vec{a}$
   (c) $3\vec{a}$ (d) $\vec{0}$

7. Inverse of the matrix $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ is :
   (a) $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ (b) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{bmatrix}$
   (c) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ (d) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$

8. If $|\vec{a}| = 3, |\vec{b}| = 4$, then a value of λ for which $\vec{a} + \lambda \vec{b}$ is perpendicular to $\vec{a} - \lambda \vec{b}$ is :
   (a) $\frac{9}{16}$ (b) $\frac{3}{4}$
   (c) $\frac{3}{2}$ (d) $\frac{4}{3}$

9. The projection of $\vec{a} = 2\hat{i} + 3\hat{j} - 2\hat{k}$ on $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ is :
   (a) $\frac{1}{\sqrt{14}}$ (b) $\frac{2}{\sqrt{14}}$
   (c) $\sqrt{14}$ (d) $\frac{-2}{\sqrt{14}}$

10. A line passes through the points $(6, -7, -1)$ and $(2, -3, 1)$. The direction cosines of the line so directed that the angle made by it with the positive direction of x-axis is acute, are :
    (a) $\frac{2}{3}, -\frac{2}{3}, -\frac{1}{3}$ (b) $-\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$
    (c) $\frac{2}{3}, -\frac{2}{3}, \frac{1}{3}$ (d) $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$

11. The maximum of the function $3\cos x - 4\sin x$ is :
    (a) 2   (b) 3
    (c) 4   (d) 5

12. If the distance 's' metres traversed by a particle in t seconds is given by $s = t^3 - 3t^2$, then the velocity of the particle when the acceleration is zero, in m/s. is :
    (a) 3   (b) -2
    (c) -3 (d) 2

13. For the curve $y^n = a^{n-1} x$ if the subnormal at any point is a constant then n is equal to :
    (a) 1   (b) 2
    (c) -2 (d) 0

14. If $x = A\cos 4t + B\sin 4t$ then $\dfrac{d^2x}{dt^2}$ is equal to :
    (a) $-16x$ (b) $16x$
    (c) x (d) $-x$

15. If tangent to the curve $x = at^2$, $y = 2at$ is perpendicular to x-axis, then its point of contact is :
    (a) (a, a) (b) $(0, a)$
    (c) $(0, 0)$ (d) $(a, 0)$

16. The general solution of the differential equation $\dfrac{dy}{dx} + \dfrac{1 + \cos 2y}{1 - \cos 2x} = 0$ is given by :
    (a) $\tan y + \cot x = c$ (b) $\tan y - \cot x = c$
    (c) $\tan x - \cot y = c$ (d) $\tan x + \cot y = c$

17. The degree of the differential equation $\left(1 + \left(\dfrac{dy}{dx}\right)^2\right)^{3/4} = \left(\dfrac{d^2y}{dx^2}\right)^{1/3}$ is :
    (a) 2   (b) 4
    (c) 9   (d) 1

18. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is, (in square units) :
    (a) $\dfrac{5}{3}$ (b) $\dfrac{5}{2}$
    (c) $\dfrac{5}{12}$ (d) $\dfrac{12}{5}$

19. $\displaystyle\int_0^{\pi/8} \cos^3 4\theta \, d\theta$ is equal to :
    (a) $\dfrac{5}{3}$ (b) $\dfrac{5}{4}$
    (c) $\dfrac{1}{3}$ (d) $\dfrac{1}{6}$

20. $\displaystyle\int_0^{\pi/2} \dfrac{\cos x - \sin x}{1 + \cos x \sin x} \, dx$ is equal to :
    (a) 0   (b) $\dfrac{\pi}{2}$ (c) $\dfrac{\pi}{4}$ (d) $\dfrac{\pi}{6}$

21. If $ax^2 - y^2 + 4x - y = 0$ represents a pair of lines, then a is equal to :
    (a) -16 (b) 16   (c) 4   (d) -4

22. What is the equation of the locus of a point which moves such that 4 times its distance from the x-axis is the square of its distance from the origin ?
    (a) $x^2 + y^2 - 4y = 0$ (b) $x^2 + y^2 - 4|y| = 0$
    (c) $x^2 + y^2 - 4x = 0$ (d) $x^2 + y^2 - 4|x| = 0$

23. Equation of the straight line making equal intercepts on the axes and passing through the point $(2, 4)$ is :
    (a) $4x - y - 4 = 0$ (b) $2x + y - 8 = 0$
    (c) $x + y - 6 = 0$ (d) $x + 2y - 10 = 0$

24. If the area of the triangle with vertices $(x, 0)$, $(1, 1)$ and $(0, 2)$ is 4 sq units, then the value of x is :
    (a) -2 (b) -4
    (c) -6 (d) 8

25. $\displaystyle\lim_{\theta \to \frac{\pi}{4}} \dfrac{\frac{\pi}{2} - \theta}{\cot \theta}$
    (a) 0   (b) -1
    (c) 1   (d) ∞

26. The probability that A can solve a problem is 2/3 and B can solve it is 3/4. If both attempt the problem, what is the probability that the problem gets solved ?
    (a) 11/12   (b) 7/12
    (c) 5/12   (d) 9/12

27. The radius of the circle passing through the point $(6, 2)$ and two of whose diameters are $x + y = 6$ and $2x + 2y = 4$ is :
    (a) 4   (b) 6   (c) 20   (d) $\sqrt{20}$

28. If $(0, 6)$ and $(0, 3)$ are respectively the vertex and focus of a parabola, then its equation is :
    (a) $x^2 + 12y = 72$ (b) $x^2 - 12y = 72$
    (c) $y^2 - 12x = 72$ (d) $y^2 + 12x = 72$

29. For the ellipse $24x^2 + 9y^2 - 150x - 90y + 225 = 0$ the eccentricity e is equal to :
    (a) $\dfrac{2}{5}$ (b) $\dfrac{3}{5}$ (c) $\dfrac{4}{5}$ (d) $\dfrac{1}{5}$

30. If the foci of the ellipse $\dfrac{x^2}{16} + \dfrac{y^2}{b^2} = 1$ and the hyperbola $\dfrac{x^2}{144} - \dfrac{y^2}{81} = \dfrac{1}{25}$ coincide, then the value of b^2 is :
    (a) 1   (b) 7
    (c) 5   (d) 9

31. The differential coefficient is $f(\sin x)$ with respect to x where $f(x) = \log x$ is :

(a) $\tan x$
(b) $\cot x$
(c) $f(\cos x)$
(d) $\frac{1}{x}$

32. If $f(x) = \begin{cases} \frac{1-\cos x}{x} & x \neq 0 \\ k & x = 0 \end{cases}$ is continuous at $x = 0$,

then the value of k is :

(a) 0
(b) $\frac{1}{2}$
(c) $\frac{1}{4}$
(d) $-\frac{1}{2}$

33. If $\omega = \frac{-1 + \sqrt{3i}}{2}$ then $(3 + \omega + 3\omega^2)^4$ is :

(a) 16
(b) -16
(c) 16ω
(d) $16\omega^2$

34. If $y = \tan^{-1}(\sec x - \tan x)$, then $\frac{dy}{dx}$ is equal to :

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

35. If $x + \frac{1}{x} = 2\cos\alpha$ then $x^n + \frac{1}{x^n}$ is equal to :

(a) $2^n \cos\alpha$
(b) $2^n \cos n\alpha$
(c) $2i \sin n\alpha$
(d) $2\cos n\alpha$

36. $\int_{-1}^{1} |1 - x| \, dx$ is equal to :

(a) -2
(b) 0
(c) 2
(d) 4

37. $\int \frac{dx}{x(x^7 + 1)}$ is equal to :

(a) $\log\left(\frac{x^7}{x^7 + 1}\right) + c$
(b) $\frac{1}{7}\log\left(\frac{x^7}{x^7 + 1}\right) + c$
(c) $\log\left(\frac{x^7 + 1}{x^7}\right) + c$
(d) $\frac{1}{7}\log\left(\frac{x^7 + 1}{x^7}\right) + c$

38. If a sphere of constant radius k passes through the origin and meets the axis in A, B, C then the centroid of the triangle ABC lies on :

(a) $x^2 + y^2 + z^2 = k^2$
(b) $x^2 + y^2 + z^2 = 4k^2$
(c) $9(x^2 + y^2 + z^2) = 4k^2$
(d) $9(x^2 + y^2 + z^2) = k^2$

39. $\int \frac{dx}{x^2 + 2x + 2}$ is equal to :

(a) $\sin^{-1}(x + 1) + c$
(b) $\sin h^{-1}(x + 1) + c$
(c) $\tan h^{-1}(x + 1) + c$
(d) $\tan^{-1}(x + 1) + c$

40. If a tangent to the curve $y = 6x - x^2$ is parallel to the line $4x - 2y - 1 = 0$, then the point of tangency on the curve is :

(a) (2, 8)
(b) (8, 2)
(c) (6, 1)
(d) (4, 2)

41. A four digit number is formed of the figures 1, 2, 3, 5 with no repetitions. The probability that the number is divisible by 5 is :

(a) $\frac{3}{4}$
(b) $\frac{1}{4}$
(c) $\frac{1}{8}$
(d) none of these

42. The number of solutions for the equation $x^2 - 5|x| + 6 = 0$ is :

(a) 4
(b) 3
(c) 2
(d) 1

43. How many numbers of 4 digits can be formed from the digits of the number 112233 ?

(a) 30
(b) 60
(c) 90
(d) 120

44. The last digit in 7^{300} is :

(a) 7
(b) 9
(c) 1
(d) 3

45. If $\frac{\log x}{a - b} = \frac{\log y}{b - c} = \frac{\log z}{c - a}$, then xyz is equal to :

(a) 0
(b) 1
(c) -1
(d) 2

46. The smallest positive integer n for which $(1 + i)^{2n} = (1 - i)^{2n}$ is :

(a) 1
(b) 2
(c) 3
(d) 4

47. If $\cos^{-1} p + \cos^{-1} q + \cos^{-1} r = \pi$ then $p^2 + q^2 + r^2 + 2pqr$ is equal to :

(a) 3
(b) 1
(c) 2
(d) -1

48. If $\sin^{-1} \frac{x}{5} + \csc^{-1} \frac{5}{4} = \frac{\pi}{2}$, then x is equal to :

(a) 1
(b) 4
(c) 3
(d) 5

49. If $0 \leq x \leq \pi$ and $81^{\sin^2 x} + 81^{\cos^2 x} = 30$, then x is equal to :

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

50. The equation of the director circle of the hyperbola $\frac{x^2}{16} - \frac{y^2}{4} = 1$ is given by :

(a) $x^2 + y^2 = 16$
(b) $x^2 + y^2 = 4$
(c) $x^2 + y^2 = 20$
(d) $x^2 + y^2 = 12$

51. If Q_1 is the set of all relations other than 1 with the binary operation $*$ defined by $a*b = a + b - ab$ for all a, b in Q_1, then the identity in Q_1 with respect to $*$ is :

   (a) 1   (b) 0   (c) – 1   (d) 2

52. The circle $x^2 + y^2 - 8x + 4y + 4 = 0$ touches :

   (a) x-axis
   (b) y-axis
   (c) both axis
   (d) neither x-axis nor y-axis

53. The function $f(x) = \log(1 + x) - \dfrac{2x}{2 + x}$ is increasing on :

   (a) $(0, \infty)$ (b) $(-\infty, 0)$
   (c) $(-\infty, \infty)$ (d) none of these

54. The minimum value of $\left(1 + \dfrac{1}{\sin^n \alpha}\right)\left(1 + \dfrac{1}{\cos^n \alpha}\right)$ is :

   (a) 1   (b) 2
   (c) $(1 + 2^{n/2})^2$ (d) none of these

55. The value of k so that $x^2 + y^2 + kx + 4y + 2 = 0$ and $2(x^2 + y^2) - 4x - 3y + k = 0$ cut orthogonally is :

   (a) $\dfrac{10}{3}$ (b) $-\dfrac{8}{3}$ (c) $-\dfrac{10}{3}$ (d) $\dfrac{8}{3}$

56. $\lim\limits_{x \to \infty}\left(1 - \dfrac{4}{x - 1}\right)^{3x - 1}$ is equal to :

   (a) e^{12} (b) e^{-12}
   (c) e^4 (d) e^3

57. If $A + B + C = 180°$ then $\Sigma \tan \dfrac{A}{2} \tan \dfrac{B}{2}$ is equal to :

   (a) 0   (b) 1
   (c) 2   (d) 3

58. In a triangle ABC if $b = 2, B = 30°$ then the area of the circumradius of triangle ABC in square units is :

   (a) π (b) 2π
   (c) 4π (d) 6π

59. If $\sin x + \sin^2 x = 1$, then $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x$ is equal to :

   (a) 1   (b) 2
   (c) 3   (d) 0

60. If R denotes the set of all real number, then the function $f : R \to R$ defined $f(x) = |x|$ is :

   (a) one-one only
   (b) onto only
   (c) both one-one and onto
   (d) neither one-one nor onto

Answers

PHYSICS

1.	(b)	2.	(d)	3.	(d)	4.	(a)	5.	(c)	6.	(c)	7.	(a)	8.	(b)	9.	(c)	10.	(c)
11.	(c)	12.	(d)	13.	(c)	14.	(b)	15.	(b)	16.	(c)	17.	(c)	18.	(b)	19.	(c)	20.	(a)
21.	(c)	22.	(b)	23.	(c)	24.	(b)	25.	(c)	26.	(c)	27.	(c)	28.	(d)	29.	(b)	30.	(c)
31.	(b)	32.	(b)	33.	(b)	34.	(c)	35.	(b)	36.	(c)	37.	(b)	38.	(c)	39.	(a)	40.	(b)
41.	(b)	42.	(a)	43.	(b)	44.	(b)	45.	(b)	46.	(a)	47.	(a)	48.	(c)	49.	(d)	50.	(d)
51.	(d)	52.	(d)	53.	(d)	54.	(d)	55.	(c)	56.	(b)	57.	(b)	58.	(a)	59.	(a)	60.	(d)

CHEMISTRY

1.	(a)	2.	(c)	3.	(d)	4.	(c)	5.	(d)	6.	(b)	7.	(d)	8.	(c)	9.	(c)	10.	(a)
11.	(c)	12.	(b)	13.	(b)	14.	(c)	15.	(a)	16.	(b)	17.	(d)	18.	(a)	19.	(c)	20.	(a)
21.	(b)	22.	(c)	23.	(a)	24.	(d)	25.	(b)	26.	(b)	27.	(c)	28.	(a)	29.	(b)	30.	(d)
31.	(a)	32.	(d)	33.	(c)	34.	(a)	35.	(b)	36.	(a)	37.	(b)	38.	(a)	39.	(d)	40.	(a)
41.	(d)	42.	(c)	43.	(b)	44.	(d)	45.	(a)	46.	(b)	47.	(b)	48.	(a)	49.	(d)	50.	(b)
51.	(c)	52.	(a)	53.	(d)	54.	(d)	55.	(c)	56.	(c)	57.	(d)	58.	(a)	59.	(b)	60.	(c)

MATHEMATICS

1.	(c)	2.	(b)	3.	(a)	4.	(c)	5.	(b)	6.	(a)	7.	(d)	8.	(b)	9.	(b)	10.	(a)
11.	(d)	12.	(c)	13.	(b)	14.	(a)	15.	(c)	16.	(b)	17.	(d)	18.	(c)	19.	(d)	20.	(a)
21.	(b)	22.	(b)	23.	(c)	24.	(c)	25.	(d)	26.	(a)	27.	(d)	28.	(a)	29.	(b)	30.	(a)
31.	(a)	32.	(a)	33.	(c)	34.	(c)	35.	(b)	36.	(c)	37.	(b)	38.	(c)	39.	(d)	40.	(a)
41.	(b)	42.	(d)	43.	(c)	44.	(d)	45.	(b)	46.	(b)	47.	(b)	48.	(c)	49.	(a)	50.	(d)
51.	(b)	52.	(b)	53.	(a)	54.	(d)	55.	(b)	56.	(b)	57.	(b)	58.	(c)	59.	(a)	60.	(d)