EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER–1995

PHYSICS

1. Energy band gap E_g in an insulator is of the order of :
   (a) 6 eV (b) 0.6 eV
   (c) – 6 eV (d) zero
2. Indium impurity in germanium makes it into a :
   (a) *n*-type semiconductor
   (b) *p*-type semiconductor
   (c) insulator
   (d) intrinsic semiconductor
3. The energy produced in the sun is by :
   (a) burning of fossil fuel
   (b) radioactivity
   (c) fission
   (d) fusion
4. In a nuclear reactor the function of the moderator is :
   (a) to slow down neutrons
   (b) to absorb neutrons
   (c) to speed up neutrons
   (d) to catalyse the reaction
5. Energy obtained when 1 mg mass is completely converted to energy is (in joule) :
   (a) 3×10^2 (b) 3×10^{10}
   (c) 9×10^{10} (d) 9×10^2
6. Nuclear forces are :
   (a) short range and charge dependent
   (b) short range and charge independent
   (c) long range and charge dependent
   (d) long range and charge independent
7. The threshold wavelength for a certain metal is 2000 Å. The work function of the metal is :
   (a) 6.2 J (b) 6.2 eV
   (c) 6.2 MeV (d) 6.2 keV
8. The age of pottery is determined by archeologists using a radio isotope of :
   (a) carbon (b) cobalt
   (c) iodine (d) phosphorous
9. X-rays are a stream of :
   (a) electrons (b) phonons
   (c) photons (d) protons
10. The first line in the Lyman series has wavelength λ. The first line in Balmer series has wavelength :
    (a) $\frac{27}{5}\lambda$ (b) $\frac{5}{27}\lambda$ (c) $\frac{9}{2}\lambda$ (d) $\frac{2}{9}\lambda$
11. In an intrinsic semiconductor at room temperature number of electrons and holes are :
    (a) equal (b) zero
    (c) unequal (d) infinity
12. In forward bias in a *p-n* junction, the potential barrier :
    (a) decreases
    (b) increases
    (c) remains unchanged
    (d) becomes zero
13. If $\hat{i}$ denotes a unit vector along incident light ray, $\hat{r}$ a unit vector along refracted ray into medium of refractive index μ and $\hat{n}$ a vector normal to boundary of media directed towards incident medium, then the law of refraction can be written as :
    (a) $\hat{i} \cdot \hat{n} = \mu (\hat{r} \cdot \hat{n})$ (b) $\hat{i} \times \hat{n} = \mu (\hat{n} \times \hat{r})$
    (c) $\hat{i} \times \hat{n} = \mu (\hat{r} \times \hat{n})$ (d) $\mu (\hat{i} \times \hat{n}) = \hat{r} \times \hat{n}$
14. Which of the following has no dimensions ?
    (a) Angular velocity
    (b) Momentum
    (c) Angular momentum
    (d) Strain

15. The dimensions of resistance × capacitance are same as for :
(a) frequency (b) energy
(c) time period (d) current

16. A body is projected vertically up with speed u takes time T to reach maximum height H. Pick out correct statement :
(a) it reaches $H/2$ distance in a time $T/2$
(b) it has speed u at time $T/2$
(c) it has speed $u/2$ at the height $H/2$
(d) it has the same velocity at time $2T$

17. The displacement of a particle moving in a straight line is given by $x = 2t^2 + t + 5$ where x is expressed in metre and 't' in second. The acceleration at $t = 2$ sec is :
(a) 4 m/s^2 (b) 8 m/s^2
(c) 10 m/s^2 (d) 15 m/s^2

18. Two forces of equal magnitude F act at a point. If the angle between them is θ, then the magnitude of the resultant force is :
(a) $F\sqrt{2(1-\sin\theta)}$ (b) $F\sqrt{2(1+\sin\theta)}$
(c) $2F\sin\frac{\theta}{2}$ (d) $2F\cos\left(\frac{\theta}{2}\right)$

19. A uniform chain of length L hangs partially from table and held in equilibrium by friction. If greatest length of chain that hangs without slipping is l then the coefficient of friction between chain and table is :
(a) $\frac{l}{2}$ (b) $\frac{l}{L+l}$ (c) $\frac{l}{L-l}$ (d) $\frac{l}{L+1}$

20. A wave is given by the equation $y = A\sin 2\pi\ (ft - x/\lambda)$. Its maximum particle velocity is four times the wave velocity. When λ is :
(a) πA (b) $\pi A/2$
(c) $\pi A/4$ (d) $\pi A/8$

21. At high altitude, a body explodes at rest into two equal fragments with one of the fragments receiving horizontal velocity 10 m/s. The time when the radius vectors connecting point of explosion to fragments make 90° is : ($g = 10$ m/s^2)
(a) 10 s (b) 4 s (c) 2 s (d) 1 s

22. The moment of inertia of a solid sphere of mass M and radius R about the tangent is :
(a) $\frac{2}{5}MR^2$ (b) $\frac{7}{5}MR^2$
(c) $\frac{2}{3}MR^2$ (d) $\frac{-5}{3}MR^2$

23. Two bodies have masses $2m$ and m. Their kinetic energies are in the ratio 8 : 1, their linear monetum are in the ratio of :
(a) 1 : 1 (b) 2 : 1 (c) 4 : 1 (d) 8 : 1

24. A body falling for 2 sec covers a distance s which is equal to that covered in next 1 sec. If $g = 10$ m/s^2, the distance s is :
(a) 30 m (b) 10 m (c) 60 m (d) 20 m

25. Two trolleys of masses m and $3m$ are connected by a spring. The spring is compressed and released the trolleys move off in opposite directions and come to rest after travelling distances s_1 and s_2 respectively. Assuming coefficient of friction is same for both the ratio of s_1 to s_2 is :
(a) 1 : 9 (b) 1 : 3 (c) 3 : 1 (d) 9 : 1

26. A simple harmonic oscillator has an amplitude A. The potential energy is one-fourth of the total energy. When the displacement is :
(a) $\frac{A}{\sqrt{2}}$ (b) $\frac{A}{2}$ (c) $\frac{A}{4}$ (d) $\frac{A}{2\sqrt{2}}$

27. The orbital speed for an earth satellite near the surface of the earth is 7 km/sec. If the radius of the orbit is 4 times the radius of the earth the orbital speed would be :
(a) 3.5 km/s (b) 7 km/s
(c) $7\sqrt{2}$ km/s (d) 14 km/s

28. A stone tied to a string rotated with uniform speed in a vertical plane. If the mass of the stone is m, length of the string is r and the speed of the stone is v, the tension in the string when the stone is at its lowest point is (g = acceleration due to gravity) :
(a) mg (b) $\frac{mv^2}{r}$
(c) $\frac{mv^2}{r} - mg$ (d) $\frac{mv^2}{r} + mg$

29. An iron ball of mass 0.2 kg is heated to 100°C and put into a block of ice at 0°C. 25 g of ice melts, then specific heat of iron (in cal/g°C) is [Latent heat of fusion of ice = 80 cal/g] :
(a) 1 (b) 0.1 (c) 0.8 (d) 0.08

30. The pressure of a gas in a closed vessel is increased by 0.4% when heated by 1°C, the initial temperature of the gas is :
(a) 23°C (b) 250°C (c) −23°C (d) 300 K

31. A cube is subjected to a unifrom volume compression if the side of the cube decreases by 1% the bulk strain is :
(a) 0.01 (b) 0.06 (c) 0.02 (d) 0.03

32. A wire stretches by 0.01 m when it is stretched by a certain force. Another wire of the same material but double the length and double the diameter is stretched by the same force. The elongation is :
(a) 0.005 m (b) 0.01 m
(c) 0.02 m (d) 0.04 m

33. Stationary waves are setup in an air column. If the velocity of sound in air is 330 m/s and frequency is 165 Hz, the distance between the nodes is :
(a) 2 m (b) 1 m (c) 0.5 m (d) 4 m

34. When the temperature increases the surface tension of a liquid :
(a) increases
(b) decreases
(c) remains unchanged
(d) varies depending upon the nature of the liquid

35. A diatomic gas molecule has translational, rotational and vibrational degrees of freedom. The ratio of specific heats $\frac{C_P}{C_V}$ is :
(a) 1.67 (b) 1.4 (c) 1.29 (d) 1.33

36. One mole of a gas occupies 100 ml at 50 mm pressure. The volume of 2 mole of the gas at 100 mm pressure and same temperature is :
(a) 50 ml (b) 100 ml (c) 200 ml (d) 500 ml

37. In an equilateral triangular prism, the angle of minimum deviation for a certain wavelength is 40°. The corresponding angle of incidence is :
(a) 30° (b) 60° (c) 45° (d) 50°

38. An observer is moving away from a source of sound of frequency 100 Hz at a speed of 33 m/s. If the speed of the sound in air is 330 m/s and the observed frequency is :
(a) 90 Hz (b) 100 Hz
(c) 91 Hz (d) 110 Hz

39. Which of the following statements is not true for the velocity of sound in gas ?
(a) Independent of pressure
(b) Increases with increasing temperature
(c) Dependent on molecular weight
(d) Greater in dry gas than in moist gas

40. Two indentical stringed instruments have a frequency of 100 Hz. The tension in one of them is increased by 4%. If they are now sounded together the number of beats per second is :
(a) 1 (b) 8 (c) 4 (d) 2

41. The least distance of distinct vision is 25 cm. The magnifying power of a simple microscope of focal length 5 cm is :
(a) $\frac{1}{5}$ (b) 5 (c) $\frac{1}{6}$ (d) 6

42. The dark lines in the solar spectrum are due to :
(a) lack of certain elements in the sun
(b) black body radiation
(c) absorption of certain wavelengths by the outer layers
(d) scattering

43. In Huygen's eyepiece, the eye lens has focal length of f. The equivalent focal length of the eyepiece is :
(a) $\frac{3}{4}f$ (b) $\frac{3}{2}f$ (c) $4f$ (d) $2f$

44. The electric potential at the centre of a charged conductor is :
(a) zero
(b) twice that on the surface
(c) half that on the surface
(d) same as on the surface

45. A bar magnet of magnetic moment $\vec{M}$ is placed in a magnetic field of induction $\vec{B}$. The torque exerted on it is :
(a) $\vec{M}\ \vec{B}$ (b) $-\vec{M}\times\vec{B}$
(c) $\vec{M}\times\vec{B}$ (d) $\vec{B}\times\vec{M}$

46. When a diamagnetic substance is brought near north or south pole of a bar magnet it is :
(a) attracted by the poles
(b) repelled by the poles
(c) attracted by the north pole and repelled by the south pole
(d) repelled by the north pole and attracted by the south pole

47. The energy stored in a capacitor is given by (V = voltage, C = capacitance, q = charge) :

(a) qV (b) $\frac{1}{2}qV$

(c) $1-\frac{1}{2}CV$ (d) $\frac{1}{2}\frac{q}{C}$

48. A parallel plate capacitor has a capacitance of 10 μF without dielectric. A dielectric of dielectric constant 2 is used to fill exactly half the thickness between the plates. The capacitance in μF, now is :

(a) 10 (b) 20

(c) 15 (d) 13.33

49. An ammeter whose resistance is 180 Ω shows full scale deflection when the current is 2 mA. The shunt required to convert into an ammeter reading 20 mA is (in ohm) :

(a) 18 (b) 20 (c) 0.1 (d) 10

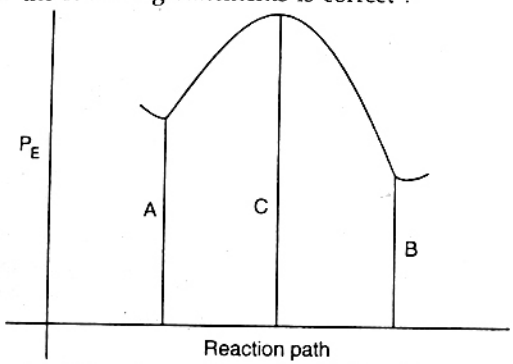
50. Four bulbs each marked 40 W, 250 V are connected in series with 250 V source. The total power output is :

(a) 10 W (b) 40 W

(c) 160 W (d) 320 W

CHEMISTRY

1. With respect to the figure given which of the following statements is correct ?



(a) ΔE for forward reaction is $C - B$

(b) ΔE for the forward reaction is $B - A$

(c) $E_{forward} > E_{backward}$

(d) ΔE for reverse reaction is $C - A$

2. The rate of a reaction $2A + 3B + 4C \rightarrow$ products, is equal to $R = [A]^2 [B]^3 [C]^4$ The overall order of the reaction is :

(a) 9 (b) 5 (c) 2 (d) 3

3. For a reaction $A + B \rightarrow$ products, the rate of the reaction was doubled, when concentration of A was doubled. When the concentration of A and B were doubled, the rate was again doubled. The order of the reaction with respect to A and B are :

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

4. The unit of rate of first order reaction is :

(a) s^{-1} (b) $L\ mol^{-1}\ s^{-1}$

(c) $mol\ L^{-1}\ s^{-1}$ (d) no units

5. The time for half life of a first order reaction is 1 hour. What is the time taken for 87.5% completion of the reaction ?

(a) 1 hour (b) 2 hours

(c) 3 hours (d) 4 hours

6. The compound formed when 2-butene is treated with acidified $KMnO_4$ is :

(a) acetaldehyde (b) acetic acid

CH_2OH CH_2—$CHOH$

(c) | (d) |

CH_2OH CH_2—$CHOH$

7. The products formed when ethyl chloride is treated with AgCN is :

(a) $C_2H_5CN + AgCl$ (b) $C_2H_5NC + AgCl$

(c) $C_2H_4 + AgCl$ (d) $C_2H_5 + NO + AgCl$

8. Which of the following compounds does not give a positive iodoform test ?

(a) Ethanol (b) Acetone

(c) Acetaldehyde (d) Methanol

9. The number of structural isomers possible for $C_3H_5Cl_3$ is :

(a) 11 (b) 8 (c) 5 (d) 6

10. A compound has an empirical formula CH_2O. Its vapour density is 45. Its molecular formula is :

(a) $C_3H_6O_8$ (b) $C_3H_6O_3$

(c) $C_4H_8O_4$ (d) $C_5H_{10}O_3$

11. The compound which gives n-hexane on heating with sodium in dry ether :

(a) ethyl bromide

(b) n-propyl bromide

(c) methyl bromide

(d) n-butyl bromide

12. In the following reaction the product R is :

$$CaC_2 \xrightarrow{H_2O} P \xrightarrow[\text{tube}]{\text{hot iron}} Q \xrightarrow[AlCl_3]{CH_3Cl} R$$

(a) benzene (b) toluene
(c) ethylbenzene (d) n-propyl benzene

13. Rutherford's experiment on scattering of α-particles showed for the first time that the atom has :
(a) nucleus (b) electron
(c) proton (d) neutron

14. Which of the following molecules has the highest dipole moment ?
(a) CO_2 (b) NF_3 (c) BCl_3 (d) CCl_4

15. The radius of the second Bohr's orbit is :
(a) 0.053 nm (b) 0.106 nm
(c) 0.212 nm (d) 0.0265 nm

16. Nuclides having equal number of neutrons but differing in mass numbers and atomic numbers are called :
(a) isomers (b) isotopes
(c) isotones (d) isobars

17. To fill in the blanks in the following reaction

$$_{95}Am^{241} + X \rightarrow {}_{97}Bk^{243} + Y$$

X and Y should be :
(a) $X = 2_0n^1$ $Y = {}_2\alpha^4$ (b) $X = \alpha$ $Y = 2e$
(c) $X = 2e$ $Y = \alpha$ (d) $X = \alpha$ $Y = 2n$

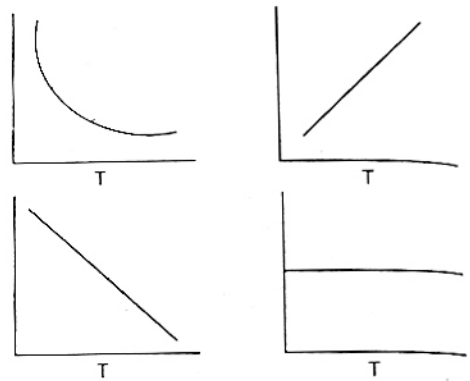
18. The order of decrease in atomic radii for Be; Na; Mg is :
(a) Na > Mg > Be (b) Mg > Na > Be
(c) Be > Na > Mg (d) Be > Mg > Na

19. The metal which is not ferromagnetic is :
(a) iron (b) manganese
(c) cobalt (d) nickel

20. The name of the element with atomic number 100 was adopted in honour of :
(a) Alfred Nobel
(b) Enrico fermi
(c) Dimitri Mendeleef
(d) Albert Einstein

21. Blue prints are based on the formation of a transition metal cyanide complex.The metal is :
(a) manganese (b) cobalt
(c) chromium (d) iron

22. For an ideal gas a plot of PV/RT versus T will look like :



(a) PV/RT (b) PV/RT
(c) PV/RT (d) PV/RT

23. Which of the following is a representation of Charle's law ?
(a) $P_1T_1 = P_2T_2$ (b) $P_1T_2 = P_2T_1$
(c) $P_1V_1 = P_2V_2$ (d) $V_1T_2 = V_2T_1$

24. Equal masses of methane and oxygen are introduced into a vessel at 27°C.What fraction of the total pressure is due to oxygen ?
(a) 1/10 (b) 1/2 (c) 1/3 (d) 1/4

25. A given mass of gas obeys Boyle's law at certain temperature. Which one of the plots will not give a straight line :
(a) V versus $1/P$ (b) P versus $1/V$
(c) log P versus log V
(d) P versus V

26. Which of the following is not a peroxide ?
(a) Na_2O_2 (b) BaO_2 (c) CrO_5 (d) PbO_2

27. In the following two reactions :
(1) $2H_2O_2 \longrightarrow 2H_2O + O_2$
(2) $H_2O_2 + 2I^- + 2H^+ \longrightarrow I_2 + 2H_2O$
H_2O_2 acts as :
(a) an oxidising agent
(b) a reducing agent
(c) both oxidising agent and reducing agent respectively
(d) both reducing agent and oxidising agent respectively

28. Which of the following alkali metals has the greatest tendency for the half reaction
$M_{(g)} \longrightarrow M^+_{(g)} + e^-$
(a) Sodium (b) Lithium
(c) Potassium (d) Caesium

29. The glass which contains PbO mainly is :
(a) soda glass (b) flint glass
(c) pyrex glass (d) borosil

30. Beryllium shows diagonal relationship with aluminium. Which one of the following similarity is not correct ?
(a) Be_2C like Al_4C_3 yields methane on hydrolysis
(b) Be like Al is rendered passive by HNO_3
(c) $Be(OH)_2$ like $Al(OH)_3$ is strongly basic
(d) Be forms berylliates and Al form aluminates.

31. Which of the following nitrogen halides is most stable ?
(a) NI_3 (b) NBr_3
(c) NCl_3 (d) NF_3

32. The compound formed during the setting or delting of the plaster of Paris is :
(a) cement (b) gypsum
(c) anhydrite (d) morton

33. The following statements is not true as far as BF_3 is concerned :
(a) electron deficient compound
(b) Lewis acid
(c) ionic compound
(d) covalent compound

34. The oxy acid of phosphorus in which phosphorus has the lowest oxidation state is :
(a) hypo phosphorus acid
(b) *ortho* phosphoric acid
(c) pyro phosphoric acid
(d) *meta* phosphoric acid

35. The chief product of electrolysis of Al_2O_3 at the anode in the Hall's process is :
(a) H_2 (b) Na (c) AlF_3 (d) O_2

36. Ordinary glass is a combination of the following :
(a) SiO_2, Na_2SiO_3, $CaSiO_3$
(b) SiO_2, Na_2CO_3, $CaCO_3$
(c) Na_2CO_3, K_2CO_3, SiO_2
(d) SiO_2, $PbCO_3$, $CaSiO_3$

37. Water gas is essentially a mixture of :
(a) $CO_2 + H_2$ (b) $CO + H_2$
(c) $CO_2 + N_2 + H_2$ (d) $CO_2 + N_2$

38. Which of the following is correct with respect to the V^{th} group elements ?
(a) All the elements exhibit allotropy
(b) Except nitrogen all elements exhibit allotropy
(c) All elements expect Nitrogen and bismuth exhibit allotropy
(d) All elements except nitrogen and arsenic exhibit allotropy

39. Catalyst used in the manufacture of HNO_3 in Ostwald process :
(a) Platinum gauze
(b) V_2O_5
(c) Fe /Mo
(d) MnO_2

40. Which of the following is paramagnetic ?
(a) N_2O_4 (b) NO
(c) N_2O_3 (d) N_2

41. Preparation of fluorine by direct electrolysis of liquid HF is not practicable because :
(a) very high temperature is needed
(b) electrolytic products are different from fluorine
(c) very low temperature is required
(d) HF is a non-electrolyte

42. The oxidation state of iodine in ICl_2^- is :
(a) +1 (b) −1
(c) +2 (d) −3

43. When 6 volumes of oxygen undergoes complete reaction to ozone,the number of moles of ozone formed are :
(a) 6 (b) 3 (c) 4 (d) 2

44. Which one of the following would you expect to have highest electronegativity ?
(a) Mg(atomic number 12)
(b) S (atomic number 16)
(c) B (atomic number 5)
(d) Te (atomic number 52)

45. The mole percentage of oxygen in a mixture of 7.0 g of nitrogen and 8.0 g, of oxygen is :
(a) 8 (b) 16 (c) 24 (d) 50

46. Which of the following can act both as Bronsted acid and Bronsted base ?
(i) HCO_3^- (ii) NH_3 (iii) O_2 (iv) HCl
(a) (i) and (ii) (b) (ii) and (iii)
(c) none of them (d) All of them

47. Which one of the following is least likely to act as a Lewis base ?
(a) PCl_3 (b) SCl_2 (c) I^- (d) I^+

48. Which one of the following is not a Lewis acid ?
(a) BF_3 (b) $AlCl_3$
(c) $BeCl_2$ (d) $SnCl_2$

49. When a copper wire is dipped in aqueous $AgNO_3$ solution, the solution turns blue. The reason for this is :
(a) oxidation of silver
(b) reduction of copper
(c) oxidation of copper
(d) reduction of silver

50. How many grams of copper would be deposited if 3.00 ampere of current is passed through a solution of $CuSO_4$ for 4 hours ? [At. wt. of Cu = 63.54]
(a) 7.11 (b) 14.22
(c) 28.44 (d) 56.88

MATHEMATICS

1. The sub-normal to the curve $xy = c^2$ at any point varies directly as :
(a) cube of the ordinate
(b) square of the ordinate
(c) ordinate
(d) none of these

2. The minimum value of $a^2 \sec^2\alpha + b^2 \operatorname{cosec}^2\alpha$ is :
(a) $a^2 - b^2$ (b) $2(a^2 + b^2)$
(c) $(a-b)^2$ (d) $(a+b)^2$

3. The value of $\int \frac{dx}{(1+x)^{1/2} - (1+x)^{1/3}}$ is :
(a) $6\left[\frac{(1+x)^{1/2}}{3} + \frac{(1+x)^{1/3}}{2} + (1+x)^{1/6} + \log\{(1+x)^{1/6} - 1\} + c\right]$
(b) $6\left[\frac{(1+x)^{1/2}}{3} + \frac{(1+x)^{1/3}}{2} + (1+x)^{1/6} + \log(1+x) + c\right]$
(c) $6\left[\frac{(1+x)^3}{3} + \frac{(1+x)^2}{2} + (1+x)^6 + \log(1+x) + c\right]$
(d) none of these

4. If $u = \log(\sec x + \sec y + \sec z)$, $\Sigma \cot x \frac{du}{dx}$ is equal to :
(a) 1 (b) 2
(c) 3 (d) 4

5. If $u = \log\left(\frac{x^2+y^2}{x+y}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to :
(a) 1 (b) 2
(c) 3 (d) 4

6. $\int_0^\infty (a^{-x} - b^{-x})\,dx$ is equal to :
(a) $\frac{1}{\log a} - \frac{1}{\log b}$ (b) $\log a - \log b$
(c) $\log a + \log b$ (d) $\frac{1}{\log a} + \frac{1}{\log b}$

7. If $f(x) = \begin{cases} \frac{\tan x}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$ at $x = 0$ $f(x)$ is :
(a) differentiable (b) continuous
(c) discontinuous (d) none of these

8. If $y = e^{m \sin^{-1} x}$, then $(1-x^2)\,y_3 - 3xy_2$ is :
(a) my^2 (b) $(1+m^2y)$
(c) $m^2 y_1$ (d) $(1+m^2)\,y_1$

9. The area enclosed by the parabola $y^2 = 8x$ and the line $y = 2x$ is :
(a) $\frac{4}{3}$ sq units (b) $\frac{3}{4}$ sq units
(c) $\frac{1}{4}$ sq units (d) none of these

10. $\int \frac{e^x}{x+2}[1 + (x+2)\log(x+2)]\,dx$ is equal to :
(a) $e^x \log(x+2) + c$ (b) $\frac{e^x}{x+2} + c$
(c) $e^x(x+2) + c$ (d) $e^x(x-2) - c$

11. $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is :
(a) $\frac{\log x}{(1+\log x)^2}$ (b) $\frac{\log x}{1+\log 2}$
(c) $\frac{\log x}{(1+\log x)^3}$ (d) none of these

12. $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$ is equal to :

(a) $\frac{\pi^2}{8}$ (b) $\frac{\pi^3}{8}$ (c) $\frac{\pi^4}{8}$ (d) $-\frac{\pi^2}{4}$

13. If $y = \cos(m \sin^{-1} x)$, the value of $(1-x^2) y_2 - x y_1$ is :

(a) $-m^2 y$ (b) $\frac{y}{m^2}$

(c) $m^2 y$ (d) $\frac{m^4}{8}$

14. The sum of the subtangent and subnormal to the curve
$x = c[2\cos\theta - \log(\text{cosec}\,\theta + \cot\theta)]$ and $y = c \sin 2\theta$ is :

(a) $c\cos\theta$ (b) $2c\sin\theta$

(c) $3c(1+\sin^2\theta)$ (d) $4c\cos\theta(1+4\sin^2\theta)$

15. $\sqrt{\tan y} = e^{\cos 2x} \cdot \sin x$, $\frac{dy}{dx}$ is equal to :

(a) $\sin 2y(\cot x - 2\sin 2x)$
(b) $\sin 2x(\cos y - \sin y)$
(c) $\cos 2y \cos 2x$
(d) $\sin 2y \sin 2x$

16. $\int_0^1 x \tan^{-1} x\, dx$ is equal to :

(a) $\frac{\pi}{4} - \frac{1}{2}$ (b) $\frac{\pi}{8} + \frac{1}{2}$

(c) $\frac{\pi}{4} + \frac{1}{2}$ (d) $\frac{\pi}{8} - \frac{1}{2}$

17. The value of $\int_0^4 e^x dx$ an using simpson's $\frac{1}{3}$rd rule, taking $h = 1$ (given $e = 2.72$, $e^2 = 7.39$, $e^3 = 20.09$, $e^4 = 54.60$) approximately is :

(a) 57.325
(b) 53.875
(c) 58.873
(d) 57.325

18. The unit vector perpendicular to each of the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} + 4\hat{j} - \hat{k}$ is :

(a) $\frac{3\hat{i} + 4\hat{j} - \hat{k}}{\sqrt{155}}$ (b) $\frac{2\hat{i} - \hat{j} + \hat{k}}{\sqrt{155}}$

(c) $\frac{-3\hat{i} + 5\hat{j} + 11\hat{k}}{\sqrt{155}}$ (d) none of these

19. The component of $\vec{b}$ perpendicular to $\vec{a}$, is :

(a) $(\vec{b} \cdot \vec{c}) \cdot \vec{a}$ (b) $\frac{\vec{a} \times (\vec{b} \times \vec{a})}{|\vec{a}|^2}$

(c) $\vec{a} \times (\vec{b} \times \vec{c})$ (d) none of these

20. The equation to the plane containing the lines $\vec{r} - \vec{a} = t\vec{b}$, $\vec{r} - \vec{b} = s\vec{a}$, is :

(a) $[\vec{r}\ \vec{a}\ \vec{b}] = 0$
(b) $\vec{r} \cdot \vec{a} = \vec{a} \cdot \vec{b}$
(c) $\vec{r} \cdot \vec{a} = \vec{r} \cdot \vec{s}$
(d) $\vec{r} \cdot \vec{s} = \vec{a} \cdot \vec{b}$

21. $\vec{a} \times [\vec{b} \times (\vec{c} \times \vec{a}) + \vec{p} \times \vec{q}]$ is equal to :

(a) $(\vec{a} \cdot \vec{q})\vec{p} - (\vec{a} \cdot \vec{p})\vec{q} + (\vec{b} \cdot \vec{a})(\vec{a} \times \vec{c}) - (\vec{b} \times \vec{c})$
(b) $(\vec{a} \cdot \vec{q})\vec{p} - (\vec{a} \cdot \vec{p})\vec{q} + (\vec{b} \cdot \vec{a})(\vec{a} \times \vec{c})$
(c) $\vec{a} \times ((\vec{p} \cdot \vec{q}) + [\vec{a}\ \vec{b}\ \vec{c}]\vec{c}$
(d) none of these

22. The vector equation of a plane containing three non-collinear points $(\vec{a}, \vec{b}, \vec{c})$ is :

(a) $\vec{r} \cdot \{\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b}\} = [\vec{a}\ \vec{b}\ \vec{c}]$
(b) $\vec{r} \cdot [\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}] = [\vec{a}\ \vec{b}\ \vec{c}]$
(c) $\vec{r} \times [\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}] = [\vec{a}\ \vec{b}\ \vec{c}]$
(d) none of these

23. The vector equation of a straight line passes through $\vec{a}$, $\vec{b}$ and $\vec{c}$ is :

(a) $(\vec{r} - \vec{a}) \times (\vec{b} \times \vec{c}) = 0$
(b) $(\vec{r} - \vec{a}) \cdot (\vec{b} - \vec{c}) = 0$
(c) $\vec{r} \cdot [\vec{a} \cdot \vec{b} \cdot \vec{c}] = 0$
(d) none of these

24. The vector equation of a plane through the points $A(3, -5, -1)$, $B(-1, 5, 7)$ and parallel to the vector $3\hat{i} - \hat{j} + 7\hat{k}$ is :

(a) $\vec{r} \cdot (3\hat{i} - 5\hat{j} - \hat{k}) = 0$
(b) $\vec{r} \cdot (3\hat{i} + 2\hat{j} - \hat{k}) = 0$
(c) $\vec{r} \cdot (\vec{A} \times \vec{B}) = 0$
(d) none of these

25. If the vector $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + m\hat{j}$, $\hat{i} + \hat{j} + \hat{k}$ are coplanar, the value of m is :

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

26. f and h are functions from $A \to B$, when $A = \{a, b, c, d\}$, $B = \{s, t, u\}$, defined as follows :
$f(a) = t, f(b) = s, f(c) = s,$
$f(d) = u, h(a) = s, h(b) = t,$
$h(c) = s, h(a) = u, h(d) = u$
which one of the following statement is true ?
(a) f and h are functions
(b) f is a function and h is not a function
(c) f and h are not functions
(d) none of these

27. The modulus and principal of argument of $1 + i$ are :
(a) $\left(\frac{1}{\sqrt{2}}, \frac{\pi}{4}\right)$ (b) $\left(\sqrt{2}, \frac{\pi}{4}\right)$
(c) $\left(\sqrt{2}, \frac{\pi}{8}\right)$ (d) none of these

28. If n is a positive integer, $n^3 + 2n$ is divisible by :
(a) 6 (b) 2 (c) 3 (d) 5

29. If $x = \{8^n - 7^{n-1} : n \in N\}$ and $y = \{49(n-1) : n \in N\}$, then :
(a) $x \leq y$ (b) $x < y$
(c) $x = y$ (d) none of these

30. The square root of $5 + 2\sqrt{6}$ is equal to :
(a) $\sqrt{3} + 2$ (b) $\sqrt{3} - \sqrt{2}$
(c) $\sqrt{2} - \sqrt{3}$ (d) $\sqrt{3} + \sqrt{2}$

31. If $\log 2 + \frac{1}{2}\log a + \frac{1}{2}\log b = \log(a + b)$, then :
(a) $a = b$ (b) $a = -b$
(c) $a = 2, b = 0$ (d) $a = 10, b = 1$

32. How many different combination of 5 can be formed from 6 men and 4 women on which exact 3 men and 2 women serve?
(a) 6 (b) 20 (c) 60 (d) 120

33. The set of matrices
$A_\alpha = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ forms :
(a) group under addition
(b) group under multiplication
(c) group under division
(d) none of these

34. The number of elements of group $G = \{a, a^2, a^3, a^4, a^5, a^6\}$ can be used as generators of group are :
(a) 6 (b) 2
(c) 7 (4) 4

35. If $1, \omega, \omega^2$ are the cube roots of unity, then the set $\{1, \omega, \omega^2\}$ with respect to multiplication form a :
(a) cyclic group of order = 6
(b) group of order = 5
(c) cyclic group of order = 4
(d) cyclic group of order = 3

36. If $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$, then $(A - 2I)(A - 3I)$ is equal to :
(a) O (b) I (c) $-I$ (d) $4I$

37. The value of $(i)^i$ is equal to :
(a) ω (b) ω^2
(c) $\frac{\pi}{3}$ (d) none of these

38. If $\Delta = \begin{vmatrix} a-b-c & 2b & 2c \\ 2a & b-c-a & 2c \\ 2a & 2b & c-a-b \end{vmatrix}$, the value of Δ is equal to :
(a) $(a+b+c)^2$ (b) $(a+b+c)^4$
(c) $(a+b+c)^3$ (d) $(a+b+c)$

39. $\begin{vmatrix} 1 & 1 & 1 \\ \sin A & \sin B & \sin C \\ \sin^2 A & \sin^2 B & \sin^2 C \end{vmatrix}$ is equal to :
(a) $\frac{1}{8R^3}(a-b)(b-c)(c-a)$
(b) $8R^3$
(c) $(a-b)(b-c)(c-a)$
(d) $\frac{1}{4R}(c-b)(a-c)(b-a)$

40. The order of matrix A is 3×5 and that of B is 2×3, then the order of matrix BA is :
(a) 2×3 (b) 3×2
(c) 2×5 (d) 5×2

41. The inverse of matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is :
(a) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (b) 0
(c) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ (d) none of these

42. If $A=\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & \lambda \end{bmatrix}$ is a singular matrix, then λ is :
(a) 2 (b) 3 (c) 4 (d) 15

43. $C_1 + 4C_2 + 7C_3 + \ldots + (3n-2)\,C_n$ is equal to :
(a) $(3n-4)^{n+1}.\,2$ (b) $(3n-4)^{2n}$
(c) $(3n-4)\,2^{n-1} - 2$ (d) none of these

44. The term independent of x in the expansion of $\left(ax + \frac{b}{x}\right)^{14}$ is :
(a) $14!\,a^7 . b^7$ (b) $\frac{14!}{7!}\,a^7 . b^7$
(c) $\frac{14!}{(7!)^2}\,a^7 b^7$ (d) $\frac{14!}{(7!)^3}\,a^7 . b^7$

45. If ${}^nC_4$, ${}^nC_5$, ${}^nC_6$ are in A.P., then n is :
(a) 14 (b) 12 (c) 17 (d) 18

46. $\tan\left(7\frac{1}{2}\right)^\circ$ is equal to :
(a) $\frac{2\sqrt{2} - (1+\sqrt{3})}{\sqrt{3}-1}$ (b) $\frac{1+\sqrt{3}}{1\sqrt{3}}$
(c) $\frac{1}{\sqrt{3}} + \sqrt{3}$ (d) none of these

47. The value of $\cos 255^\circ + \sin 165^\circ$ is :
(a) 0 (b) $\frac{\sqrt{3}-1}{\sqrt{2}}$
(c) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (d) $\frac{\sqrt{2}+1}{\sqrt{2}}$

48. If a is any real number, the number of roots of $\cot x - \tan x = a$, in the first quadrant is :
(a) 0 (b) 1
(c) 2 (d) none of these

49. The value of $\Sigma a^2 (\cos^2 B - \cos^2 C)$ is equal to :
(a) 0 (b) 1 (c) 2 (d) 3

50. If $a \cos A = b \cos B$ in any ΔABC, then C is equal to :
(a) 45° (b) 60°
(c) 90° (d) none of these

51. The sides of Δ are 13, 14, 15 units, the radius of a incircle is :
(a) 4 (b) 2
(c) 14 (d) none of these

52. If r_1, r_2, r_3 are the ex-radius & r is inradius of a Δ and $2s$ is the perimeter of a triangle. The value of $\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3}$ is equal to :
(a) $\frac{\Delta}{8}$ (b) $\frac{2}{r}$ (c) $\frac{1}{r}$ (d) $\frac{3}{r}$

53. The smallest value of θ satisfying the equation $\sqrt{3}(\cot\theta + \tan\theta) = 4$ is :
(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{3}$
(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{2}$

54. A person walking along a straight road towards a hill observed at two points distance $\sqrt{3}$ km. The angle of elevation on the hill to be 30° and 60°. The height of the hill is :
(a) $\frac{3}{2}$ km (b) $\sqrt{\frac{2}{3}}$ km
(c) $\frac{\sqrt{3}+1}{2}$ km (d) $\sqrt{3}$ km

55. The domain of $\sin^{-1} x$ is :
(a) $(0, 2\pi)$ (b) $(-1, 1)$
(c) $(-\infty, \infty)$ (d) $(1, 1)$

56. The value of $\cosh^{-1}(1)$ is :
(a) 0 (b) 1
(c) $\log(\sqrt{2}+1)$ (d) $\log(\sqrt{2}-1)$

57. The range of $\cosh x$ is :
(a) $(-\infty, \infty)$ (b) $(-1, 1)$
(c) $(1, \infty)$ (d) $(0, 1)$

58. The modulus of $\sqrt{2i} - \sqrt{-2i}$ is :
(a) 0 (b) 2 (c) $\sqrt{2}$ (d) $2\sqrt{2}$

59. The triangle formed by the point 1, $\frac{1+i}{\sqrt{2}}$, and i as vertices in the argand diagram is :
(a) equilateral (b) right angled
(c) isosceles (d) none of these

60. The value of $\left(\frac{1+i\sqrt{3}}{1-i\sqrt{3}}\right)^6 - \left(\frac{1-i\sqrt{3}}{1+i\sqrt{3}}\right)^6$ is :
(a) 1 (b) 7 (c) -2 (d) 0

61. If $1, \omega, \omega^2$ are the cube roots of unity, then $\frac{a + b\omega + c\omega^2}{c + a\omega + b\omega^2}$ is equal to :
(a) 1 (b) ω (c) ω^2 (d) ω^3

62. The modulus and principal argument of complex number $\frac{1+2i}{1-(1-i)^2}$ are respectively :
(a) 0, 1 (b) 1, 0 (c) 1, 1 (d) 0, 0

63. If $\cos A + \cos B + \cos C = 0$ and $\angle A + \angle B + \angle C = 180°$, then value of $\cos 3A + \cos 3B + \cos 3C$ is :
(a) 3
(b) -3
(c) $4 \cos A \cos B \cos C$
(d) $12 \cos A \cos B \cos C$

64. The value of
$\cos\left(\frac{2\pi}{15}\right)\cos\left(\frac{4\pi}{15}\right)\cos\left(\frac{8\pi}{15}\right)\cos\left(\frac{14\pi}{15}\right)$ is :
(a) $\frac{1}{8}$ (b) $\frac{1}{12}$ (c) $\frac{1}{16}$ (d) $\frac{3}{4}$

65. θ is an acute angle and $\tan\theta = \frac{1}{\sqrt{7}}$, then the value of $\frac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta}$ is :
(a) $\frac{3}{4}$ (b) $\frac{1}{2}$ (c) 2 (d) $\frac{5}{4}$

66. The probability that A can solve a problem is $\frac{2}{3}$ and that B can solve it is $\frac{3}{4}$. What is the probability that the problem is solved ?
(a) $\frac{11}{12}$ (b) $\frac{7}{12}$ (c) $\frac{5}{12}$ (d) $\frac{9}{12}$

67. Six coins are tossed simultaneously the probability of getting at least 4 tails, is :
(a) $\frac{11}{64}$ (b) $\frac{21}{32}$ (c) $\frac{11}{32}$ (d) $\frac{15}{44}$

68. If a random variable X has a poisson distribution such that $P(X=1) = P(X=2)$ its mean & variance are :
(a) 1, 1 (b) 2, 2 (c) 2, $\sqrt{3}$ (d) 2, 4

69. If X, has a poisson distribution, and $P(X=2) = \frac{2}{3}P(X=1)$, then $P(X=3)$ is :
(a) $\frac{32}{81} \cdot e^{-4/3}$ (b) $\frac{36}{81} \cdot e^{-4/3}$
(c) $\frac{34}{81} e^{-34/3}$ (d) none of these

70. The probability that a candidate secure a seat in engineering through an examination is $\frac{1}{10}$. 7 candidates are selected from a centre. The probability that exactly two will get success, is :
(a) $15(0.1)^2 (0.9)^5$
(b) $20(0.1)^2 (0.9)^5$
(c) $2(0.1)^2 (0.9)^5$
(d) none of these

71. If X is a random variable in which distribution given below :

X :	-2	-1	0	1	2	3
$P(X)$:	0.1	c	0.2	$2c$	0.3	c

the value of c and variance are :
(a) 0.1, 2.16 (b) 0.01, 2.16
(c) 1, 2.16 (d) none of these

72. The probability of securing a seat is twice that of failure. The probability of securing at least 4 success into 6 trials is :
(a) $\frac{490}{729}$ (b) $\frac{494}{729}$
(c) $\frac{496}{729}$ (d) none of these

73. If $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{2}$, $P(A \cup B) = \frac{5}{8}$, then $P(A \cap B)$ is :
(a) $\frac{3}{8}$ (b) $\frac{1}{8}$
(c) $\frac{2}{8}$ (d) $\frac{5}{8}$

74. The combined equation to a pair of straight lines passing through the origin and inclined at an anlge of 30° and 60° respectively with x-axis is :
(a) $\sqrt{3}(x^2+y^2) = 4xy$
(b) $4(x^2+y^2) = \sqrt{3}xy$
(c) $x^2 + \sqrt{3}y^2 - 2xy = 0$
(d) $x^2 + 3y^2 - 2xy = 0$

75. The centre and radius of circle with segment of the line $x + y = 1$ cut off by the co-ordinate axes as diameter, is :
(a) (1, 1), $\sqrt{2}$ (b) $\left(\frac{1}{2}, \frac{1}{2}\right)$, $\sqrt{2}$
(c) $\left(\frac{1}{2}, \frac{1}{2}\right)$, $\frac{1}{\sqrt{2}}$ (d) (0, 0), 1

76. The equation of the circle which touches the lines $x = 0$, $y = 0$, $x = c$ is :
(a) $x^2 + y^2 + cx + cy + c^2 = 0$
(b) $x^2 + y^2 - 2cx - 2cy + c^2 = 0$
(c) $x^2 + y^2 + cx + cy + \frac{c^2}{4} = 0$
(d) $x^2 + y^2 - cx - cy + \frac{c^2}{4} = 0$

77. The points $(4, -2)$, $(3, b)$ are conjugate with respect to the circle $x^2 + y^2 = 24$, if b is :
(a) 6 (b) -6 (c) 12 (d) -4

78. A circle of the co-axial system on which limiting (0, 0), (1, 0) is :
(a) $x^2 + y^2 - 2x = 0$ (b) $x^2 + y^2 - 8x = 0$
(c) $x^2 + y^2 = 1$ (d) $x^2 + y^2 + 2x + 1 = 0$

79. The distance between parallel lines given by the equation
$x^2 + 2\sqrt{2}\,xy + 2y^2 + 4x - 8 + 4\sqrt{2}y = 0$ is :
(a) 4 (b) $2\sqrt{2}$ (c) $4\sqrt{2}$ (d) 8

80. The tangents to the parabola $y^2 = 4ax$ at $(at_1^2, 2at_1)$ and $(at_2^2, 2at_2)$ intersect in its axis, then :
(a) $t_1 = t_2$ (b) $t_1 t_2 = -1$
(c) $t_1 t_2 = 2$ (d) $t_1 = -t_2$

81. The locus of poles with respect to parabola $y^2 = 4ax$ of tangents to the circle $x^2 + y^2 = 4a^2$ is :
(a) $x^2 - y^2 = 4a^2$ (b) $x^2 + y^2 = 4a^2$
(c) $x^2 - y^2 = a^2$ (d) $x^2 + y^2 = a^2$

82. The locus of poles of tangents to the circle $x^2 + y^2 = r^2$ with respect to ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is :
(a) $\frac{x^2}{a^4} + \frac{y^2}{b^4} = \frac{1}{r^2}$ (b) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = \frac{1}{r^2}$
(c) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = \frac{1}{r^2}$ (d) none of these

83. e and e' are the eccentricity of hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and its conjugate hyperbola, the value of $\frac{1}{e^2} + \frac{1}{e'^2}$ is :
(a) 0 (b) 1
(c) 2 (d) 3

84. The locus of mid point of focal chords of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is :
(a) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = \frac{ex}{a}$ (b) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = \frac{ex}{a}$
(c) $x^2 + y^2 = a^2 + b^2$ (d) none of these

85. The area of the triangle formed by the lines $x^2 + 4xy + y^2 = 0$, $x + y = 1$ is :
(a) $\sqrt{3}$ sq. units (b) 2 sq. units
(c) 1 sq. units (d) $\frac{\sqrt{3}}{2}$ sq. units

86. If a polar of a point on the circle $x^2 + y^2 = a^2$ with respect to $x^2 + y^2 = b^2$ touches the circle $x^2 + y^2 = c^2$, then a, b, c are in :
(a) A.P. (b) H.P.
(c) G.P. (d) none of these

87. The co-ordinates of the orthocentre of the triangle formed by the lines $2x^2 - 3xy + y^2 = 0$ and $x + y = 1$, are :
(a) (1, 1) (b) $\left(\frac{1}{2}, \frac{1}{2}\right)$
(c) $\left(\frac{1}{3}, \frac{1}{3}\right)$ (d) $\left(\frac{1}{4}, \frac{1}{4}\right)$

88. The pair of straight lines $h(x^2 - y^2) + pxy = 0$ bisects the angle between the pair $ax^2 + 2hxy + by^2 = 0$ the value of p is :
(a) $a - b$ (b) $b - a$ (c) $a + b$ (d) $-a - b$

89. The combined equation of the tangents to the parabola $y^2 = 4ax$ from an external point $A(x_1, y_1)$ is :
(a) $(y^2 - 4ax)(y_1^2 - 4ax_1) = (yy_1 - 2ax - 2ax_1)^2$
(b) $y^2 - 4ax = (yy_1 - 2ax - 2ax_1)^2$
(c) $y^2 - 4ax = (yy_1 - 2ax)^2$
(d) none of these

90. The number of normals to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ from an external point is :
(a) 2 (b) 4
(c) 5 (d) 9

91. If PSP' is a focal chord of parabola $y^2 = 4ax$ and SL is the semilatus rectum, then SP, SL, SP' are in :
(a) A.P. (b) H.P.
(c) G.P. (d) none of these

92. If e and e_1 are eccentricities of hyperbola $xy = c^2$ and $x^2 - y^2 = c^2$, then $e^2 + e_1^2$ is equal to :
(a) 1 (b) 4 (c) 6 (d) 8

93. If $\frac{x}{a} + \frac{y}{b} = \sqrt{2}$ touches the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then its eccentric angle θ is equal to :
(a) 0° (b) 90° (c) 45° (d) 60°

94. $\lim_{x \to 0} \frac{x}{\sqrt{x+4} - 2}$ is equal to :
(a) 4 (b) $\sqrt{2}$ (c) $2\sqrt{2}$ (d) $\frac{1}{\sqrt{2}}$

95. $\lim_{x \to 0} \frac{\sin x \sin^{-1} x}{x^2}$ is equal to :
(a) 0 (b) 1 (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

96. The derivative of $\cos^{-1}(2x^2 - 1)$ w.r. to $\cos^{-1}(x)$ is :
(a) 2 (b) $\frac{2}{x}$
(c) $\frac{1}{2\sqrt{1-x^2}}$ (d) $\sqrt{1-x^2}$

97. $\sin y = x \sin(a + y)$, then $\frac{dy}{dx}$ is :
(a) $\frac{\sin a}{\sin^2 (a+y)}$ (b) $\frac{\sin^2 (a+y)}{\sin a}$
(c) $\sin a \sin^2 (a+y)$ (d) $\frac{\sin^2 (a+y)}{a}$

98. A particle is projected vertically upward. Its height h at a time t has the relation $h = 60t - 16t^2$. The velocity with which it hits the ground is :
(a) 30 (b) 60 (c) 90 (d) 180

99. Each side of an equilateral triangle expands at 2 cm/sec. The rate of increase of the area when each side is 10, is :
(a) $10\sqrt{2}$ sq. units (b) $10\sqrt{3}$ sq. units
(c) 10 sq. units (d) 5 sq. units

100. The equation of the tangent to the curve $y = be^{-x/a}$ where it crosses the y-axis, is :
(a) $ax + by = 1$ (b) $\frac{x}{a} + \frac{y}{b} = 1$
(c) $\frac{x}{b} + \frac{y}{a} = 1$ (d) $ax - by = 1$

Answers

Physics

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

Chemistry

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

Mathematics

1.	(a)	2.	(d)	3.	(a)	4.	(a)	5.	(a)	6.	(a)	7.	(b)	8.	(d)	9.	(a)	10.	(a)
11.	(a)	12.	(d)	13.	(a)	14.	(d)	15.	(a)	16.	(a)	17	(b)	18.	(c)	19.	(b)	20.	(a)
21.	(b)	22.	(a)	23.	(a)	24.	(b)	25.	(c)	26.	(b)	27.	(b)	28.	(c)	29.	(c)	30.	(d)
31.	(a)	32.	(d)	33.	(b)	34.	(b)	35.	(d)	36.	(a)	37.	(d)	38.	(c)	39.	(a)	40.	(c)
41.	(a)	42.	(b)	43.	(c)	44.	(c)	45.	(a)	46.	(d)	47.	(a)	48.	(d)	49.	(a)	50.	(c)
51.	(a)	52.	(c)	53.	(c)	54.	(a)	55.	(b)	56.	(a)	57.	(c)	58.	(b)	59.	(c)	60.	(d)
61.	(c)	62.	(b)	63.	(d)	64.	(c)	65.	(a)	66.	(a)	67.	(c)	68.	(b)	69.	(a)	70.	(d)
71.	(a)	72.	(c)	73.	(b)	74.	(a)	75.	(c)	76.	(d)	77.	(b)	78.	(d)	79.	(a)	80.	(d)
81.	(a)	82.	(a)	83.	(b)	84.	(a)	85.	(d)	86.	(c)	87.	(b)	88.	(b)	89.	(a)	90.	(b)
91.	(b)	92.	(b)	93.	(c)	94.	(a)	95.	(b)	96.	(a)	97.	(b)	98.	(b)	99.	(b)	100.	(b)

Hints & Solutions

PHYSICS

1. In an insulator the energy band gap is of the order of 6 eV to 7 eV.
2. When Germanium is doped with indium impurity, then it becomes p-type semiconductor, because indium is trivalent impurity, so out of four covalent bonds, one bond has a vaccancy of electron *i.e.*, one hole is produced.
3. The energy produced in sun is by fusion process. In fusion reaction on sun, hydrogen nuclei combine with each other to form helium nuclei, due to which a large amount of energy is released.
4. In nuclear reactor, the function of moderator is to slow down the fast moving thermal neutrons which are produced in the reaction.
5. $m = 1 \text{ mg} = 1 \times 10^{-6} \text{ kg}$
   From Einstein's mass energy equivalance relation, energy released
   $E = mc^2$
   $c =$ speed of light in vacuum
   $= 3 \times 10^8$ m/s
   $E = 1 \times 10^{-6} \times (3 \times 10^8)^2$
   $= 1 \times 10^{-6} \times 9 \times 10^{16}$
   $= 9 \times 10^{10}$ J
7. Threshold wavelength $\lambda_0 = 2000$ Å
   $= 2 \times 10^{-7}$ m
   Work function $w = \dfrac{hc}{\lambda_0}$
   $h =$ Planck's constant $= 6.6 \times 10^{-34}$ J-s
   $c = 3 \times 10^8$ m/s
   $\therefore \quad w = \dfrac{6.6 \times 10^{-34} \times 3 \times 10^8}{2 \times 10^{-7}}$
   $= 3.3 \times 3 \times 10^{-19} = 9.9 \times 10^{-19}$ J
   $= \dfrac{9.9 \times 10^{-19}}{1.6 \times 10^{-19}}$ eV
   $= 6.2$ eV
8. Age of pottery is determined by the radio isotope of carbon.
9. X-rays are electromagnetic waves, so these are stream of photons.
10. For Lyman series $\dfrac{1}{\lambda_L} = R\left[\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right]$
    For first line $n_1 = 1$, $n_2 = 2$
    $\therefore \quad \dfrac{1}{\lambda_L} = R\left[\dfrac{1}{1^2} - \dfrac{1}{2^2}\right] = R\left[1 - \dfrac{1}{4}\right]$
    $\Rightarrow \quad \dfrac{1}{\lambda_L} = \dfrac{3}{4}R$
    $\Rightarrow \quad R = \dfrac{4}{3\lambda_L}$
    For Balmer series
    $\dfrac{1}{\lambda_B} = R\left[\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right]$