UPSEE- 2011 MODEL TEST PAPER

PAPER 1 (For candidates appearing for B.Tech./ B.Pharm/ B.Tech[Ag]/ B.Tech [Bio. Tech.]

(PHYSICS, CHEMISTRY and MATHEMATICS)

General Instructions:

- This model paper contain three parts of Physics, Chemistry and Mathematics
- Each Group contains ***fifty questions*** carrying ***four marks*** against each question
- There is no ***negative*** marking
- **For familiarizing the students with multiple correct MCQ's each part has been divided in three sections (A, B & C).** However, in the exam no such separate sections will be defined, the students must answer correctly all the options in order to get marks for the question.
  - Section A contains questions with only **one correct answer**
  - Section B contains questions with only **two correct answer**
  - Section C contains questions with **more than two correct answer**

PART I

Physics (200 Marks)

Section-A

The following questions have only one option correct

1. The dimensional formula for permeability is
   (a) $M^2L^2Q^{-1}$ (b) ML^2Q^{-2} (c) MLQ^{-2} (d) $M^{-1}L^2Q^{-1}$
2. Two masses *M* and 2*M* are attached with each other by a rope passing over a frictionless and massless pulley. If the pulley is accelerated upwards with acceleration *'a',* What is the value of T?

   (a) $\frac{M(g+a)}{3}$ (b) $\frac{4M(g-a)}{3}$ (c) $\frac{4M(g+a)}{3}$ (d) $\frac{M(g-a)}{3}$
3. A ball is thrown upwards. It returns to ground describing a parabola. Which of the following quantities remain constant?
   (a) The vertical component of momentum (b) The horizontal component of velocity
   (c) The speed of the ball (d) The KE of the ball
4. A boy sitting on the top most berth in the compartment of a train which is just going to stop on a railway station, drops an apple aiming at the open hand of his brother sitting vertically below his hand at a distance of above 2 metre. The apple will fall
   (a) Precisely on the hand of his brother
   (b) slightly away from hand of his brother in direction of motion of train
   (c) Slightly away from hand of his brother in direction opposite to direction of motion of the

train
(d) none of the above

5. According to Kepler's, II law, the radius vector of a planet relative to sun sweeps out equal areas in equal intervals of time. The law is a consequence of conservation of conservation of
(a) linear momentum (b) angular momentum
(c) energy (d) Newton's law of gravitation
6. When Detergent like surf is added to pure water, the surface tension
(a) increases, (b) decreases (c) is unchanged (d) becomes zero
7. Earth is flattened at poles and bulged at the equator. This is due to
(a) earth revolves round the sun in elliptical orbit
(b) the angular velocity of spinning about its axis is more at the equator
(c) the centrifugal force is more at the equator than at the poles
(d) none of these
8. At 0°C a square steel bar of 1 cm side is rigidly clamped at both ends so that its length cannot increase. Young's modulus of steel is 20×10^{10} Nm^{-2} and its coefficient of linear expansion is 11×10^{-6} °C. When the temperature is raised to 10°C, the force exerted on the clamps is
(a) 2000 N (b) 2100 N (c) 2200 N (d) 4467 N
9. Two point charges Q and $-3Q$ are placed at some distance apart. If the electric field at the location of Q is E, then at the location of $-3Q$, it is
(a) $-E$ (b) $E/3$ (c) $-3E$ (d) $-E/3$
10. Two dielectrics of equal size and of constant 2 and 3 respectively fill up space between the two plates of a condenser. The ratio of capacities in two possible arrangements will be
(a) 24/25 (b) 25/24 (c) 4/5 (d) 5/4
11. What force must be exerted to immerse a wooden cube of side 4 cm and specific gravity 0.6 completely in water
(a) 38.4 gwt (b) 64 gwt (c) 25.6 gwt (d) 54.4 gwt
12. The coefficient of superficial expansion of a solid is β Its coefficient of cubical expansion is
(a) $(2/3)\beta$ (b) $(3/2)\beta$ (c) 2β (d) 3β
13. 22g of CO_2 at 27°C is mixed with 16g of O_2 at 37°C. If both gases are considered as ideal, then the temperature of mixture is
(a) 32°C (b) 27°C (c) 37°C (d) 30.5°C
14. If the temperature of the sun is doubled, the rate of energy received on earth will be increased by a factor of
(a) 2 (b) 4 (c) 8 (d) 16
15. The insulation property of air breaks down at intensity of electric field of 3MV/m maximum charge that can be given to a sphere of diameter 5 m is
(a) 2×10^{-2} C (b) 2×10^{-3} (c) 2×10^{-4} (d) 2×10^{-5} C
16. The correct relation between the specific resistance S and resistance per unit length P is
(a) S = AP (b) S = A/P (c) S = P/A (d) S = P
17. N identical drops each charged to energy E form a big drop. The energy of the big drop will be
(a) NE (b) E/N (c) $N^{5/3}E$ (d) N^2E
18. A cell of emf 1.5 V having a finite internal resistance is connected to a load resistance of 2 Ω. For maximum power transfer the internal resistance of the cell in ohms should be
(a) 4 (b) 0.5 (c) 2 (d) none of these
19. A long solenoid has a radius a and number of turns per unit length is n. If it carries a current i, then magnetic field on its axis is directly proportional to
(a) ani (b) ni (c) $(ni)/a$ (d) n^2i
20. In a resistance box, the resistance coil is doubly wound to avoid
(a) current (b) resistance (c) self-induction (d) eddy current losses

21. The ratio of specific charge *elm* of a proton to that of an α–particle is
(a) 1 : 4 (b) 1 : 2 (c) 1 : 1/4 (d) 1/2

22. When a point source of light is 1 m away from a photoelectric cell, the photoelectric current is found to be 1 mA If the same source be placed at 3 m from the same photoelectric cell, the photoelectric current will be
(a) 1/9 mA (b) 1/3 mA (c) 3 mA (d) 9 mA

23. A sample of a radioactive substance contains 2,828 atoms. If its half-life is two days, how many atoms will be left intact in the sample after one day?
(a) 2,000 (b) 1,000 (c) 1,414 (d) 707

24. A wave is reflected from a free boundary. The change of phase on reflection will be
(a) zero (b) $\pi/4$ (c) $\pi/2$ (d) π

25. A short linear object of length *b* lies along the axis of a concave mirror of focal length *f* at a distance *u* from the pole of the mirror. The size of the image is approximately equal to

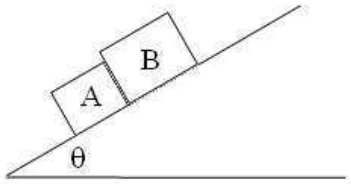
(a) $b\left(\frac{u-f}{f}\right)^{1/2}$ (b) $b\left(\frac{u-f}{f}\right)$ (c) $b\left(\frac{f}{u-f}\right)^{1/2}$ (d) $b\left(\frac{f}{u-f}\right)^{2}$

Section-B

Instructions: The following questions have two correct answers and you must tick both the correct choices for getting any marks for that question.

A particle moves with initial velocity v_0 and retardation αv where v is the velocity at any time t.
(a) The particle will cover a total distance v_0/α
(b) The particle will come to rest after time after time t = $1/\alpha$
(c) The particle will move for a very long time
(d) The velocity of particle will become $v_0/2$ after time $1/\alpha$

26. The two blocks A and B of equal masses are initially in contact when released from rest on the inclined plane. The coefficients of friction between the inclined plane and A and B are μ_1 and μ_2 respectively



(a) If $\mu_1 > \mu_2$ the blocks will always remain in contact
(b) If $\mu_1 < \mu_2$ the blocks will slide down with different accelerations
(c) If $\mu_1 > \mu_2$, the blocks will have a common acceleration of $\frac{1}{2}(\mu_1+\mu_2)g\sin\theta$
(d) If $\mu_1 < \mu_2$ the blocks will have a common acceleration $\frac{\mu_1\mu_2 g}{\mu_1+\mu_2}\sin\theta$

27. A simple pendulum rotates in a horizontal plane with an angular velocity of ω about a fixed point P in gravity free space. There is a negative charge at P. The bob gradually emits photoelectrons (ignore the change in energy and momentum of photons and electrons). The total force acting on the bob is T.
(a) T will decrease and ω will increase
(b) T will decrease and ω will remain constant
(c) T and ω will remain unchanged
(d) The elastic strain in the string will decrease

28. A ring (R) disc (D) and solid sphere (S) and hollow sphere (H) are having same mass but different radii, all start together from rest at the top of an inclined plane and roll down without slipping.

    (a) All of them will reach the bottom of incline together
    (b) The body with maximum radius will reach the bottom first.
    (c) They will reach the bottom in the order of S,D,H,R
    (d) All of them will have same kinetic energy at the bottom

29. A coin is placed on horizontal platform, which undergoes vertical simple harmonic motion of angular velocity ω. The amplitude of oscillation is gradually increased. The coin will leave contact for the first time

    (a) At the highest position of platform
    (b) At the mean position of the platform
    (c) for an amplitude of g/ω^2
    (d) for an amplitude of $\frac{\sqrt{g}}{\omega}$

30. A spring balance reads W_1 when a ball is suspended from it. A weighing machine reads W_2 when a tank of liquid is kept on it. When the ball is immersed in liquid, the spring balance reads W_3 and weighing machine reads W_4

    (a) $W_1 > W_3$ (b) $W_1 < W_3$ (c) $W_2 < W_4$ (d) $W_2 > W_4$

31. A double star system rotating about their centre of mass only under their mutual gravitational attraction. Let the stars have masses m and 2m and let their separation be L. Their time period of rotation about their centre of masses will be proportional to

    (a) $L^{3/2}$ (b) L (c) $m^{1/2}$ (d) $m^{-1/2}$

32. A spherical body of radius r radiated power P, and its rate of cooling is R

    (a) $P \propto r$ (b) $P \propto r^2$ (c) $R \propto r^2$ (d) $R \propto \frac{1}{r}$

33. The stationary waves set up on a string have the equation $y = (2\text{mm})\sin[(6.28\text{m}^{-1})x]\cos(\omega t)$. This stationary wave is created by two identical waves, of amplitude A each moving in opposite directions along the string

    (a) A = 2 mm
    (b) A = 1 mm
    (c) The smallest length of string is 50 cm
    (d) The smallest length of string is 2 m

34. A transverse sinusoidal wave of amplitude A, wavelength λ and frequency f is travelling on a stretched string. The maximum speed of any point on string is v/10 where v is the speed of propagation of the wave. If $A = 10^{-3}$ m and v = 10 m/s then λ and f are given as

    (a) $\lambda = 2\pi \times 10^{-2}$ m
    (b) $\lambda = 10^{-3}$ m
    (c) $f = 10^3/(2\pi)$ Hz
    (d) $f = 10^3$ Hz

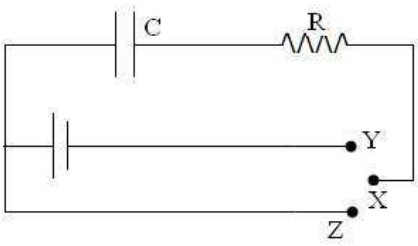
35. A dipole of moment **p** is placed in uniform electric field **E.** The force on the dipole is **F** and the torque is $\boldsymbol{\tau}$

    (a) $|\mathbf{F}| = 0$ (b) $\mathbf{F} = |\mathbf{p}|\mathbf{E}$ (c) $|\boldsymbol{\tau}| = \mathbf{p}.\mathbf{E}$ (d) $\boldsymbol{\tau} = \mathbf{p} \times \mathbf{E}$

36. In a parallel plate capacitor of plate area A, plate separation d and charge Q, the force of attraction between the plates is F. Then F is proportional to

    (a) Q^2 (b) A^{-1} (c) d (d) d^{-1}

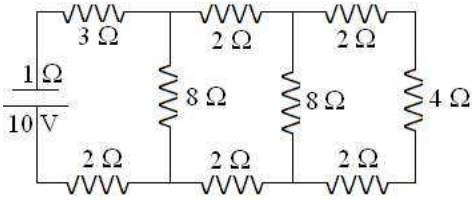
37. In the figure the capacitor C is initially without charge. X is now joined to Y for a long time, during which heat H_1 is produced in the resistance R. X is now joined to Z for a long time, during



which H_2 heat is produced in R

(a) $H_1 = H_2$
(b) $H_1 = ½H_2$
(c) $H_1 = 2H_2$
(d) The maximum energy stored in C at any time is H_2

38. In the circuit shown, the cell has emf of 10 V and internal resistance of 1 Ω.



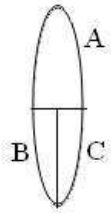
(a) current through 3 Ω resistor is 1 A.
(b) the current through 3 Ω resistor is 0.5 A
(c) The current through 4 Ω is 0.5 A
(d) The current though the 4 Ω resistor is 0.25 A

39. A flat circular coil carrying a current, has a magnetic moment μ.
(a) μ has only magnitude and no direction
(b) The direction of μ is along the normal to the plane of coil
(c) The direction of μ depends on the direction of current flow
(d) The direction of μ does not change if the current in coil is reversed

40. A charged particle is fired at an angle θ to a uniform magnetic field directed along the x axis. During this motion along a helical path, the particle will
(a) never move parallel to x axis
(b) move parallel to x axis during every rotation for all values of θ
(c) move parallel to the x axis at least once during every rotation if θ = 45°
(d) never move perpendicular to x axis

41. Which of the following assertions are correct?
(a) A neutron can decay to a proton only inside a nucleus
(b) A proton can change to a neutron only inside a nucleus
(c) An isolated neutron can change into a proton
(d) An isolated proton can change into a neutron

42. A thin symmetric double convex lens of power P is cut into three parts, A B and C as shown, then



power of

(a) A is P (b) A is 2P (c) B is P/2 (d) B is P/4

43. In a Young's double slit experiment, let A and B be two slits. A thin film of thickness t and refractive index μ is placed in front of the slit A. Let β be the fringe width. The central maximum will shift

a) towards A (b) towards B (c) by $t(\mu-1)\frac{\beta}{\lambda}$ (d) by $t\mu\frac{\beta}{\lambda}$

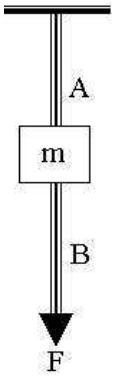
44. A ray of light travelling in transparent medium falls on a surface separating the medium from air, at an angle of incidence of 45°. The ray undergoes total internal reflection. If n is the refractive index of medium, select the possible values of n from the following

(a) 1.3 (b) 1.4 (c) 1.5 (d) 1.6

Section-C

Instructions: The following questions have more than two option correct and you must choose all the correct responses for getting marks for that question.

45. The wires A and B shown in the figure are made of same material, and have radii R_A and R_B respectively. The block between them has mass m. When the force F is mg/3, one of the wires



breaks

(a) A wire break before B if $R_A = R_B$

(b) A wire break before B if $R_A < 2R_B$.

(c) Either A or B may break if $R_A = 2R_B$

(d) The lengths of A and B must be known to predict which wire will break

46. A ball of mass m is attached to the lower end of light vertical spring of force constant k. the upper end of the spring is fixed. A ball is released from the rest with the spring in its normal (unstretched) length and comes to rest again after descending through a distance x

(a) x = mg/k

(b) x = 2mg/k

(c) The ball will have no acceleration at a position where it has descended through x/2

(d) The ball will have an upward acceleration equal to g at its lowermost position

47. A parallel plate air capacitor of capacitance C_0 is connected to a cell of emf E and then after charging capacitor is disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it

(a) The potential difference between the plates decreases K times

(b) The energy stored in capacitor decreases K times

(c) The change in energy is $\frac{1}{2}C_0E^2(K-1)$

(d) the change in energy is $\frac{1}{2}C_0E^2\left(1-\frac{1}{K}\right)$

48. When a nucleus with atomic number Z and mass number A undergoes a radioactive decay process
    (a) Both Z and A decrease, if the process is α decay
    (b) Z will decrease but A will not change if the process is β^+ decay
    (c) Z will increase and A will remain unchanged if the process is β^- decay
    (d) Z will increase and A will remain unchanged if the process is γ decay
49. If a converging beam of light is incident on a concave mirror, the reflected light
    (a) may form a real image
    (b) must form a real image
    (c) may form a virtual image
    (d) may be a parallel beam

PART-II CHEMISTRY (200 Marks)

SECTION -A

The following questions have only one correct option, tick the correct answer.

1. Vant Hoff factor for 0.1M $Ba(NO_3)_2$ is 2.74. Degree of dissociation is:
   a. 91.3% b. 87% c. 100% d. 74
2. In Arrhenius plot, intercept is equal to:
   a. $-E_a/R$ b. ln A c. ln K d. log a
3. Minimum concentration of an electrolyte which is able to cause coagulation of a sol is:
   a. emulsification value b. saponification value
   c. flocculation number d. gold number
4. Number of lone pairs of electrons on Xe in XeF_2, XeF_4, XeF_6 are:
   a. 3 , 2 , 1 b. 4 , 3 , 2 c. 2 , 3 ,1 d. 3 , 2 , 0
5. IF_5 shows which type of hybridization:
   a. sp^3d^2 b. sp^3d^3 c. sp^2d d. d^2sp^3
6. Which halide is most acidic:
   a. PCl_3 b. $SbCl_3$ c. $BiCl_3$ d.CCl_4
7. Which compound is formed when excess KCN is added to aq.$CuSO_4$:
   a. $Cu(CN)_2$ b. $K_2[Cu(CN)_6]$ c. $K[Cu(CN)_2]$
   d. $K_3[Cu(CN)_4]$
8. which of the following is an outer orbital complex:
   a. $[Ni(NH_3)_6]^{2+}$ b. $[Co(NH_3)_6]^{3+}$ c. $[Fe(H_2O)_6]^{2+}$
   d. $[Co(CN)_6]^{4-}$
9. According to crystal field split theory the fourth electron coming into the d orbital goes to e_g if:
   a. $\Delta_o > p$ b. $\Delta_o < p$ c. $\Delta_o = p$ d. $\Delta_o = 0$
10. $[CoF_6]^{3-}$ shows which type of hybridization:
    a. sp^3d^2 b. sp^3d^3 c. sp^2d d. d^2sp^3

11. which of the following exhibit stereoisomerism:
    a. 2−methyl butane b. 3−methyl butyne c. 3−methyl butanoic acid
    d. 2−methyl butanoic acid
12. Identify the state function:
    a. q b. q−w c. q/w d. q + w
13. An ideal gas expands in volume from 10^{-3} m^3 to 10^{-2} m^3 at 300K against a constant pressure of $10^5 Nm^{-2}$. What is the work done:
    a. −900 kJ b. −900 kJ c. 270 kJ d. 900 kJ
14. An organic compound C_3H_6O did not show silver mirror test but shows aldol condensation. The compound is:
    a. CH_2=CH−CH_2−OH b. CH_3−CH_2−CHO c. CH_3−CO−CH_3 d. CH_2=CH−OCH_3
15. In which mode of expression, the concentration remains independent of temperature:
    a. Molarity b. Normality c. Formality d. Molality
16. Which of the following has lowest freezing point:
    a. 0.1 molal solution of urea b. 0.1 molal solution of sucrose
    c. 0.1 molal solution of acetic acid d. 0.1 molal solution of calcium chloride
17. A crossed aldol condensation between aromatic aldehydes/ketones with aliphatic aldehydes/ketones is:
    a. Williamson's synthesis b. Sandmeyer's reaction
    c. Claisen−Schmidt condensation d. Reimer−Tiemann reaction
18. Which of the amines will show positive carbylamines reaction:
    a. Aniline b. N−methylaniline c. N,N dimethylaniline
    d. Dimethylamine
19. Diazotization is a process in which:
    a. Phenol can be differentiated from the other groups
    b. Benzene diazonium chloride is formed
    c. Aniline can be differentiated from other groups
    d. None
20. The reddish brown coloured gas formed when nitric acid is oxidized by air is:
    a. N_2O_5 b. N_2O_4 c. NO_2 d. N_2O_3
21. Carboxylic acids heated in presence of phosphorus pentaoxide yields:
    a. Acid amides b. Acid anhydrides c. Acid chlorides d. Aldehydes
22. Which of the following undergo Cannizaro's reaction:
    a. Ethanol b. Formaldehyde c. Acetaldehyde
    d. None of these
23. In Schotten Baumann reaction benzoyl chloride reacts with:
    a. Benzoic acid b. Benzaldehyde c. Phenol d. Aniline
24. Kolbe's electrolysis of potassium Ethanoate yields:
    a. Ethene b. Methane c. Ethane d. Propane
25. IUPAC name of $[Pt(NH_3)_3Br(NO_2)Cl]Cl$ is
    a. Triamminechlorobromonitroplatinum (IV) chloride
    b. Triamminechlorobromonitrochloroplatinum (IV) chloride
    c. Triamminebromochloronitroplatinum (IV) chloride
    d. Triamminenitrochlorobromoplatinum(IV) chloride

26. H_2O_2 is stored in dark coloured bottles as:
    a. Decomposes to form water
    b. Decomposes to form water & oxygen
    c. Decomposes to form oxygen
    d. Decomposes to form hydrogen & oxygen

SECTION-B

Instructions: The following questions have two correct answers and you must tick both the correct choices for getting any marks for that question.

27. Freundlich adsorption isotherm is numerically equal to:
    a. $x/m=Kp^{1/n}$
    b. $x/m=\log K+ n \log p$
    c. $\log x/m= \log K + n \log p$
    d. $\log x/m = \log K + 1/n \log p$
28. Which of the following show free movement around C−C bond:
    a. Ethane
    b. ethene
    c. propene
    d. propane
29. For an adiabatic expansion of ideal gas:
    a. $PV^{\gamma} = \text{constant}$
    b. $TV^{\gamma-1} = \text{constant}$
    c. $TP^{\gamma} = \text{constant}$
    d. $PV^{\gamma-1} = \text{constant}$
30. Which behaves as both nucleophile & electrophile:
    a. CH_3OH
    b. CH_3Cl
    c. CH_3CN
    d. HCHO
31. Grignard's reagent derived from which of the following compounds on treating with water gives the same alkane:
    a. $CH_3CH_2CH_2CH_2Cl$ b. $CH_3CH_2CH_2ClCH_3$ c. $(CH_3)_3CCl$ d. $(CH_3)_2CH_2CH_2Cl$
32. An unsaturated hydrocarbon on ozonolysis gives 1 mole of methanal , ethanal & 2 keto propanal:
    a. $CH_2=CHCH=CHCH_3$
    b.$CH_3CH=CHCH=CHCH_3$
    c. $CH_2=C(CH_3)CH=CHCH_3$
    d. $CH_2=CHC(CH_3)=CHCH_3$
33. Which of the following species have electron releasing effect
    a. —CHO
    b. $—CH_2CH_3$
    c. $—CH_3$
    d. $—C_6H_5$
34. Which of the following species are electrophilic
    a. Cl^+
    b. $AlCl_3$
    c. NH_3
    d. CH_3OCH_3
35. Which of the following pair of compounds are homologous
    a. 1–propanol and 2–propanol
    b. 1–propanol and 1–butanol
    c. 2–propanol and 2–methyl 2–propanol
    d. ethanol and propanol
36. Cyclohexane exists in which form:–
    a. boat
    b. chair
    c. planar
    d.crown
37. Which of the following is/are correct about Inductive effect
    a. It is a temporary effect
    b. it is an electron displacement effect
    c. It is always electron releasing in nature
    d. it depends on the distance from the I effect group
38. Which of the following is/are correct
    a. Resonance is delocalization of sigma electrons
    b. Hyperconjugation is delocalization of pi electrons

c. Hyperconjugation is delocalization of sigma electrons

d. Resonance is delocalization of pi electrons

39. Alcohols may act as:

a. Oxidizing agent b. Reducing agent c. Lewis base d. Bronsted acid

40. Grignard's reagent gives secondary alcohols with:

a. Ethanal b. Methanal c. Propanone d. Propanal

41. Which of the following can be distinguished using coupling reaction:

a. Phenol b. Benzene dizonium chloride

c. Aniline d. Toluene

42. Grignard's reagent is used to prepare which of the following:

a. Secondary alcohols b. Nitro compounds

c. Carboxylic acids d. Amine

43. tert−butyl methyl ether on heating with HI gives:

a. tert−butyl iodide b. Methyl iodide c. Methanol d. Isobutylene

44. Identify Lewis acids:

a. HCl b. H^+ c. H_2SO_4 d. BCl_3

45. For a rate expression Rate = $k[A]\ [B]^2$:

a. reaction is first order w.r.t. B b. reaction is second order w.r.t. A

c. reaction is first order w.r.t . A d. reaction is second order w.r.t. B

SECTION-C

Instructions: The following questions have more than two option correct and you must choose all the correct responses for getting marks for that question.

46. White P_4 has:

a. 6 P−P single bonds b. 4 P−P single bonds c. 4 lone pairs d. PPP angle of 60

47. Which of the following represents a spontaneous process:

a. $\Delta H = +, \Delta S = +$ b. $\Delta H = -, \Delta S = -$ c. $\Delta H = -, \Delta S = +$ d. $\Delta H = +, \Delta S = -$

48. For the reaction $PCl_5 \leftrightarrow PCl_3 + Cl_2$, rate of forward reaction increases by:

a. putting inert gas at constant V b. Removing Cl_2

c. putting inert gas at constant P d. putting PCl_5 gas at constant V

49. Which compounds show only sp^3 hybridized carbon:

a. cycloalkanes b. straight chain alkanes c. branched chain alkanes d. benzene

50. Which of the following species are planar:

a. Tertiary butyl free radical b. Tertiary butyl carbocation

c. Tertiary butyl carboanion d. Alkyl carboanion

PART –III –Mathematics (200 Marks)

Section A

The following questions have only one correct option, tick the correct answer.

1. If a,b,c are in GP, then the equation $ax^2 + 2bx + c = 0$ and $dx^2 + 2ex + f = 0$ are in
   a) AP b) GP c) HP d) None
2. A GP consists of an even number of terms. If the sum of all the terms is 5 times the sum of the terms occupying odd places, the common ratio is
   a) 5 b) 4 c) 3 d) 2
3. The coefficient of x^p and x^q in the expansion of $(1 + x)^{p+q}$ are
   a) equal b) equal with opposite sign
   c) reciprocal of each other d) None
4. If $x \in R$ and $\alpha = \frac{x^2}{(1+x^4)}$, then
   a) $0 \le \alpha \le 2$ b) $0 \le \alpha \le 1$ c) $0 \le \alpha \le ¼$ d) $0 \le \alpha \le ½$
5. A bag contains 100 tickets numbered 1 to 100, two tickets are drawn. If it is given that maximum number on chosen tickets is not more that 10, The probability that minimum number is 5 is
   a) 1/3 b) 1/9 c) 1/1330 d) 13/15
6. If $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 4 & 2 \\ 1 & 3 & 2 \end{bmatrix}; B = \begin{bmatrix} 10 & -4 & -1 \\ -11 & 5 & 0 \\ 9 & -5 & -1 \end{bmatrix}$ then
   a) AB = BA b) AB = 2BA c) AB = 3BA d) None
7. If the difference between mean and mode is 63, the difference between mean and median is
   a) 189 b) 21 c) 31.5 d) 48.5
8. In a group of 52 students, 16 drink tea but not coffee and 33 drink tea. Then the number of persons who take coffee but not tea is
   a) 19 b) 36 c) data insufficient d) None
9. Value of $\lim_{x\to\infty} \frac{\sqrt{x^2-1}}{2x+1}$ is
   a) 1 b) 0 c) −1 d) 1/2
10. If $y = \tan^{-1}\frac{1-x^2}{1+x^2}$, then $\frac{dy}{dx}$ is
    a) $1/(1 + x^4)$ b) $-2x/(1 + x^4)$`c) $-1/(1 + x^4)$ d) None
11. Let $y = \tan^{-1}\left(\frac{4x}{1+5x^2}\right) + \tan^{-1}\left(\frac{2+3x}{3-2x}\right); \text{then } \frac{dy}{dx} \text{ is}$
    a) $\frac{5}{1+25x^2}$ b) $\frac{1}{1+25x^2}$ c) $\frac{5}{\sqrt{1+25x^2}}$ d) $\frac{1}{\sqrt{1+25x^2}}$
12. The line bx + ay = ab touches the curve $y = be^{-x/a}$ at point
    a) (a, b/a) b) (−a, b/a) c) (a, a/b) d) None
13. If $f(x) = kx^3 - 9x^2 + 9x + 3$ is monotonically increasing in each interval, then value of k is
    a) k < 3 b) k > 3 c) k ≤ 3 d) None
14. $\int_{-1}^{1} |1-x| .dx$ equals
    a) − 2 b) 0 c) 2 d) 4
15. $\int_{-\pi}^{\pi} (1-x^2)\sin x.\cos^2 x.dx$

a) $\pi - \frac{\pi^3}{3}$ b) 0 c) $2\pi - \pi^3$ d) $\frac{7}{2} - 2\pi^3$

16. Area enclosed between curves $y^2 = 4ax$ and $x^2 = 4ay$ is
    a) $8a^2/3$ b) $16a^2/3$ c) $4a^2/3$ d) None
17. If $z + \sqrt{2}|z+1| + i = 0$ then value of z is
    a) 2 + i b) 2 − i c) −2 − i d) − 2 + i
18. If angle A in triangle ABC is given by equation $3\cos A + 2 = 0$,then sin A and cos A are roots of the equation
    a) $6x^2 + \sqrt{5}x - 5 = 0$ b) $6x^2 - 5\sqrt{5}x - 5 = 0$ c) $6x^2 - 5\sqrt{5}x + 5 = 0$ d) $6x^2 + 5\sqrt{5}x - 5 = 0$
19. If A = $\tan^{-1} x$, then value of sin 2 A is
    a) $\frac{2x}{1-x^2}$ b) $\frac{2x}{\sqrt{1-x^2}}$ c) $\frac{2x}{1+x^2}$ d) None
20. If a = 2,b = 3,c = 5 in ΔABC then the value of angle C is equal to
    a) $\pi/6$ b) $\pi/3$ c) $\pi/2$ d) None
21. The equation, $x^2 - 3xy + \lambda y^2 + 3x - 5y + 2 = 0$ represents pair of lines, if θ is angle between them value of $\text{cosec}^2\,\theta$ is
    a) 3 b) 9 c) 10 d) 100
22. The line y = mx + c is tangent to $y^2 = 4x$ if m is equal to
    a) 1 b) 2 c) 3 d) 4
23. The area of parallelogram whose diagonal coincide with following vectors is $9\sqrt{3}$, the vectors are
    a) 3i + 2j − k, 3i − j + 4k b) $\frac{3}{2}i - \frac{1}{2}j - k$;2i − 6j + 8k
    c) 3i + j − 2k; i + 3j + 4k d) None
24. If **a, b** and **c** be non zero vectors such that **a + b + c** = 0, then **a.b + b.c + c.a** is
    a) 0 b) < 0 c) > 0 d) 3
25. Bullet of 125 gm strikes a target with 400 m/s and is embedded in it. If the target weighs 10 kg and is free to move, then velocity of target will be
    a) 400/81 m/s b) 400 m/s c) 300 m/s d) None

SECTION-B

Instructions: The following questions have two correct answers and you must tick both the correct choices for getting any marks for that question.

26. One root of the equation $8x^2 - 6x + k = 0$ is the square of the other if k is
    a) 1 b) 0 c) 2 d) −27
27. The points (2a,4a), (2a,6a) and $[(2+\sqrt{3})a, 5a]$ (a > 0) are the vertices of
    a) an acute angled triangle b) an equilateral triangle
    c) an isosceles triangle d) a right angled triangle
28. The equation of a straight line passing through the point (4,5) and equally inclined to the lines 3x – 4y = 7 and 5y – 12x = 6 is
    a) 9x – 7y = 1 b) 9x + 7y = 71 c) 7x + 9y = 73 d) 7x – 9y = 17
29. The coordinates of A,B,C and D are (6,3),(–3,5), (4, –2) and (x,3x) respectively. If the area of Δ ABC = 2Δ DBC then value of x is
    a) – 3/8 b) –3 c) 11/8 d) 4

30. Coordinates of the point on the curve $2x^2 + 3xy + 4y^2 = 9$, tangent at which is parallel to chord joining points (12,2) and (1,9) are
a) (1,1) b) (1, –1) c) (–1,1) d) (–1, –1)

31. Determinant of a skew symmetric matrix of order n is
a) zero if n is odd
b) a non zero perfect square if n is odd
c) zero if n is even
d) a non zero perfect square if n is even

32. The straight line $y = 3x – 1$ touches the curve $y = x^4 – 2x^2 + 3x$ at
a) (1,2) b) (–1,4) c) (0,0) d) None of these

33. Let $A = \begin{bmatrix} 0 & 1 & 2 \\ -1 & 0 & -3 \\ -2 & 3 & 0 \end{bmatrix}$. Then
a) A is skew symmetric matrix
b) $A + A' = O$
c) A is invertible
d) None of these

34. The number of diagonals of n sided polygon is
a) $\frac{1}{2}n(n-3)$ b) $\frac{1}{2}(n-2)$ c) ${}^{n}C_2 - n$ d) None of these

35. Let A = {p,q,r} then
a) $r \in A$ b) $r \subseteq A$ c) $\{r\} \in A$ d) $\{r\} \subseteq A$

36. Let A = {a,b,c,d} and B = {c,d,e,f} then
a) A – B = {e,f}
b) $A \cap B' = \{a,b\}$
c) $A – (A \cup B) = \{a,b\}$
d) $(A \cup B) – B = \{a,b\}$

37. If $p = {}^{n}C_2$ then ${}^{p}C_2$ is
a) $3.{}^{n+1}C_4$ b) $\frac{1}{2}{}^{n+1}C_2\,{}^{n-1}C_2$ c) ${}^{n+1}C_2\,{}^{n-1}C_2$ d) None of these

38. $\int \sin^5 x.dx$ is
a) $-\frac{1}{15}\left[15\cos x - 10\cos^3 x + 3\cos^5 x\right] + C$
b) $\frac{1}{15}\left[15\cos x - 10\cos^3 x + 3\cos^5 x\right] + C$
c) $-\frac{1}{240}\left[3\cos 5x - 25\cos 3x + 150\cos x\right] + C$
d) None of these

39. $\int \frac{1}{\sqrt{\sin^3 x \sin(x+\theta)}}.dx$
a) $-2\text{cosec }\theta\sqrt{\cos\theta + \cot x.\sin\theta} + C$
b) $-\text{cosec }\theta\sqrt{\cos\theta + \cot x.\sin\theta} + C$
c) $-2\text{cosec }\theta\sqrt{\{\sin(x+\theta)/\sin x\}} + C$
d) $-2\text{cosec }\theta\sqrt{\{\cos(x-\theta)/\sin x} + C$

40. For $1 \le r \le n$ the value of ${}^{n}C_r + {}^{n-1}C_r + {}^{n-2}C_r + ... + {}^{r}C_r$ is
a) ${}^{n}C_{r+1}$ b) ${}^{n+1}C_r$ c) ${}^{n+1}C_{r+1}$ d) None of these

41. If R and R′ be two equivalence relations. Then
a) $R \cap R'$ is also an equivalence relation
b) $R \cup R'$ is equivalence
c) $R^{-1} \cap R'^{-1}$ is equivalence
d) None of these

42. The value of x for which the tangent to the curve $y = (x + 2)^2$ passes through the origin is
    a) 1 b) 2 c) −2 d) 3
43. The equation of tangent to circle $x^2 + y^2 = 25$ and passing through (− 2,11) is
    a) 4x + 3y = 25 b) 3x + 4y = 38 c) 7x + 24y = 230 d) 24x − 7y + 125=0
44. Let **p = 3i + 4j, q = 5i, r = ¼ (p + q)** and 2s **= p − q,** then
    a) |p + r| = |q + s| **b) |p + λs| = |r − λs|** **c) |p + q| = |p − q|**
    d) r is perpendicular to **s.**
45. The vector **a,b,** and **c** are of same length and taken pair wise, they form equal angles.If **a** = **i + j** , **b** = **i + k** then the coordinates of **c** are
    a) (1,0,1) b) (1,2,3) c) (−1,1,2) d) (−1/3, 4/3, −1/3)

SECTION-C

Instructions: The following questions have more than two option correct and you must choose all the correct responses for getting marks for that question.

46. In the parabola $y^2 - 2y + 8x - 23 = 0$
    a) focus is (1,1)
    b) directrix is x = 5
    c) length of double ordinate at a distance 3 units from the vertex is $4\sqrt{6}$
    d) length of latus rectum is 8
47. Differential coefficient of $\log_{10} x$ wrt x^2 is
    a) $\frac{1}{2x^2}$ b) $\frac{\log_{10} e}{2x^2}$ c) $\frac{1}{2x^2 \log_e 10}$ d) $\frac{\log_{10}\sqrt{e}}{x^2}$
48. If $(1+x)^{1/x} = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots$ then
    a) $a_0 = e$ b) $a_1 = e/x$ c) $a_3 = 11e/24$ d) None of these
49. $\int \cos(\log x).dx$
    a) $\frac{x}{\sqrt{2}}\cos\left(\log x - \frac{\pi}{4}\right)$ b) $\frac{x}{2}(\cos\log x + \sin\log x)$
    c) $\frac{x}{\sqrt{2}}\sin(\log x + \pi/4)$ d) $\frac{x}{2}(\cos\log x - \sin\log x)$
50. A particle is projected with a velocity u, at an angle α from the foot of an inclined plane whose inclination to the horizontal is β. It strikes the plane at right angles if
    a) $2\tan(\alpha - \beta) = \cot\beta$ b) $\cot(\alpha - \beta) = 2\tan\beta$ c) $\tan\alpha = \cot\beta + 2\tan\beta$
    d) None of these