

JEE Main 2020 Paper 1 (B.E./B.Tech) 7 January 2020 Shift 2 Question Paper



Conducted by the National Testing Agency (NTA)

Time Allowed: 3 Hours

Paper 1: B.E./B.Tech.

Maximum Marks: 300

General Instructions

- (i) This paper is **Paper 1 (B.E./B.Tech.)** of **JEE (Main) 2020 - Session 1**, conducted by the National Testing Agency (NTA) in Computer Based Test (CBT) mode on 7 January 2020, Shift 2. The total duration is **3 hours**.
- (ii) The paper has **75 questions** and a maximum of **300 marks**: Mathematics, Physics and Chemistry carry 25 questions (100 marks) each, in that order.
- (iii) Each subject has **two sections**. **Section A** has **20 multiple choice questions** (MCQs) with four options each. Select the most appropriate answer. **Section B** has **5 numerical value questions**.
- (iv) **All questions are compulsory**. For Section B, enter the numerical answer in the format requested in the question. Use only the constants given in the question while calculating.
- (v) **Marking scheme**: MCQs carry **+4** for a correct answer and **-1** for an incorrect answer. Numerical questions carry **+4** for a correct answer and **0** for an incorrect answer. Unanswered questions carry **0**.
- (vi) All calculations and rough work are to be done on the rough sheets only. Calculators, log tables, slide rules and electronic gadgets are not allowed.

1. The area (in sq. units) of the region $\{(x, y) \in \mathbb{R}^2 \mid 4x^2 \leq y \leq 8x + 12\}$ is :

- (A) $\frac{125}{3}$
 (B) $\frac{128}{3}$
 (C) $\frac{127}{3}$
 (D) $\frac{124}{3}$

2. Let $y = y(x)$ be the solution curve of the differential equation,

$$(y^2 - x) \frac{dy}{dx} = 1$$

, satisfying $y(0) = 1$. This curve intersects the x-axis at a point whose abscissa is :

- (A) $2 + e$ (B) $-e$
 (C) 2 (D) $2 - e$

3. Let $a_1, a_2, a_3, \dots$ be a G.P. such that $a_1 < 0$, $a_1 + a_2 = 4$ and $a_3 + a_4 = 16$. If

$$\sum_{i=1}^9 a_i = 4\lambda$$

, then λ is equal to:

- (A) 171
 (B) -171
 (C) -513
 (D) $\frac{511}{3}$

4. The number of ordered pairs (r, k) for which $6 \cdot {}^{35}C_r = (k^2 - 3) \cdot {}^{36}C_{r+1}$, where k is an integer, is :

- (A) 6 (B) 3
 (C) 2 (D) 4

5. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three unit vectors such that

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

. If

$$\lambda = \vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$$

and

$$\vec{d} = \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$$

, then the ordered pair, $(\lambda, \vec{d})$ is equal to :

- (A) $\left(\frac{3}{2}, 3\vec{a} \times \vec{c}\right)$
 (B) $\left(-\frac{3}{2}, 3\vec{c} \times \vec{b}\right)$
 (C) $\left(-\frac{3}{2}, 3\vec{a} \times \vec{b}\right)$
 (D) $\left(\frac{3}{2}, 3\vec{b} \times \vec{c}\right)$

6. If θ_1 and θ_2 be respectively the smallest and the largest values of θ in $(0, 2\pi) - \{\pi\}$ which satisfy the equation,

$$2\cot^2\theta - \frac{5}{\sin\theta}$$

+ 4 = 0, then

$$\int_{\theta_1}^{\theta_2} \cos^2 3\theta d\theta$$

is equal to :

- (A) $\frac{\pi}{9}$
 (B) $\frac{2\pi}{3}$
 (C) $\frac{\pi}{3}$
 (D) $\frac{\pi}{3} + \frac{1}{6}$

7. The value of α for which

$$4\alpha \int_{-1}^2 e^{-\alpha|x|} dx = 5$$

, is:

- (A) $\log_e 2$
 (B) $\log_e \sqrt{2}$
 (C) $\log_e \left(\frac{4}{3}\right)$
 (D) $\log_e \left(\frac{3}{2}\right)$

8. Let $f(x)$ be a polynomial of degree 5 such that $x = \pm 1$ are its critical points.

If

$$\lim_{x \rightarrow 0} \left(2 + \frac{f(x)}{x^3} \right) = 4$$

, then which one of the following is not true?

- (A) $f(1) - 4f(-1) = 4$.
 (B) $x = 1$ is a point of minima and $x = -1$ is a point of maxima of f .
 (C) $x = 1$ is a point of maxima and $x = -1$ is a point of minimum of f .
 (D) f is an odd function.

9. The coefficient of x^7 in the expression $(1+x)^{10} + x(1+x)^9 + x^2(1+x)^8 + \dots + x^{10}$ is:

- (A) 120
 (B) 330
 (C) 420
 (D) 210

10. The locus of the mid-points of the perpendiculars drawn from points on the line, $x = 2y$ to the line $x = y$ is :

- (A) $3x - 2y = 0$
 (B) $7x - 5y = 0$
 (C) $2x - 3y = 0$
 (D) $5x - 7y = 0$

11. Let α and β be the roots of the equation $x^2 - x - 1 = 0$.

If $p_k = (\alpha)^k + (\beta)^k$, $k \geq 1$, then which one of the following statements is not true?

- (A) $(p_1 + p_2 + p_3 + p_4 + p_5) = 26$
 (B) $p_5 = 11$
 (C) $p_3 = p_5 - p_4$
 (D) $p_5 = p_2 \cdot p_3$

12. Let $y = y(x)$ be a function of x satisfying

$$y\sqrt{1-x^2} = k - x\sqrt{1-y^2}$$

where k is a constant and

$$y\left(\frac{1}{2}\right) = -\frac{1}{4}$$

. Then $\frac{dy}{dx}$ at $x = \frac{1}{2}$, is equal to :

- (A) $\frac{2}{\sqrt{5}}$
 (B) $-\frac{\sqrt{5}}{2}$
 (C) $\frac{\sqrt{5}}{2}$
 (D) $-\frac{\sqrt{5}}{4}$

13. If

$$\frac{3 + i \sin \theta}{4 - i \cos \theta}$$

, $\theta \in [0, 2\theta]$, is a real number, then an argument of $\sin \theta + i \cos \theta$ is :

- (A) $\pi - \tan^{-1} \left(\frac{3}{4} \right)$
 (B) $-\tan^{-1} \left(\frac{3}{4} \right)$
 (C) $\tan^{-1} \left(\frac{4}{3} \right)$
 (D) $\pi - \tan^{-1} \left(\frac{4}{3} \right)$

14. In a workshop, there are five machines and the probability of any one of them to be out of service on a day is $\frac{1}{4}$. If the probability that at most two machines will be out of service on the same day is

$$\left(\frac{3}{4}\right)^k$$

, then k is equal to :

- (A) $\frac{17}{4}$
 (B) $\frac{17}{2}$
 (C) $\frac{17}{8}$
 (D) 4

15. Let A, B, C and D be four non-empty sets. The contrapositive statement of "If $A \subseteq B$ and $B \subseteq D$, then $A \subseteq C$ " is :

- (A) If $A \not\subseteq C$, then $A \not\subseteq B$ or $B \not\subseteq D$ (B) If $A \not\subseteq C$, then $A \not\subseteq B$ and $B \subseteq D$
 (C) If $A \subseteq C$, then $B \subseteq A$ or $D \subseteq B$ (D) If $A \not\subseteq C$, then $A \subseteq B$ and $B \subseteq D$

16. Let $A = [a_{ij}]$ and $B = [b_{ij}]$ be two 3×3 real matrices such that $b_{ij} = (3)^{(i+j-2)}a_{ij}$, where $i, j = 1, 2, 3$. If the determinant of B is 81, then the determinant of A is:

- (A) 3
 (B) $\frac{1}{3}$
 (C) $\frac{1}{9}$
 (D) $\frac{1}{81}$

17. The value of c in the Lagrange's mean value theorem for the function

$f(x) = x^3 - 4x^2 + 8x + 11$, when $x \in [0, 1]$ is:

- (A) $\frac{2}{3}$
 (B) $\frac{\sqrt{7} - 2}{3}$
 (C) $\frac{4 - \sqrt{5}}{3}$
 (D) $\frac{4 - \sqrt{7}}{3}$

18. Let the tangents drawn from the origin to the circle,

$x^2 + y^2 - 8x - 4y + 16 = 0$ touch it at the points A and B. The $(AB)^2$ is equal to :

- (A) $\frac{56}{5}$
 (B) $\frac{32}{5}$
 (C) $\frac{52}{5}$
 (D) $\frac{64}{5}$

19. If the sum of the first 40 terms of the series, $3 + 4 + 8 + 9 + 13 + 14 + 18 + 19 + \dots$ is $(102)m$, then m is equal to :

- (A) 20 (B) 5
 (C) 10 (D) 25

20. If $3x + 4y = 12\sqrt{2}$ is a tangent to the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{9} = 1$$

for some $a \in \mathbb{R}$, then the distance between the foci of the ellipse is :

- (A) $2\sqrt{5}$
 (B) $2\sqrt{7}$
 (C) 4
 (D) $2\sqrt{2}$

21. If the function f defined on

$$\left(-\frac{1}{3}, \frac{1}{3}\right)$$

by

$$f(x) =$$

$$\begin{cases} \frac{1}{x} \log_e \left(\frac{1+3x}{1-2x} \right), & \text{when } x \neq 0 \\ k, & \text{when } x = 0 \end{cases}$$

is continuous, then k is equal to _____.

22. If the system of linear equations,

$$x + y + z = 6$$

$$x + 2y + 3z = 10$$

$$3x + 2y + \lambda z = \mu$$

has more than two solutions, then $\mu - \lambda^2$ is equal to _____.

23. If the mean and variance of eight numbers 3, 7, 9, 12, 13, 20, x and y be 10 and 25 respectively, then $x \cdot y$ is equal to _____.

24. If the foot of the perpendicular drawn from the point $(1, 0, 3)$ on a line passing through $(\alpha, 7, 1)$ is

$$\left(\frac{5}{3}, \frac{7}{3}, \frac{17}{3}\right)$$

, then α is equal to _____.

25. Let $X = \{n \in \mathbb{N} : 1 \leq n \leq 50\}$. If

$A = \{n \in X : n \text{ is a multiple of } 2\}$ and

$B = \{n \in X : n \text{ is a multiple of } 7\}$, then the number of elements in the smallest subset of X containing both A and B is _____.

26. Mass per unit area of a circular disc of radius a depends on the distance r from its centre as $\sigma(r) = A + Br$. The moment of inertia of the disc about the axis, perpendicular to the plane and passing through its centre is:

- (A) $2\pi a^4 \left(\frac{A}{4} + \frac{aB}{5} \right)$
 (B) $\pi a^4 \left(\frac{A}{4} + \frac{aB}{5} \right)$
 (C) $2\pi a^4 \left(\frac{aA}{4} + \frac{B}{5} \right)$
 (D) $2\pi a^4 \left(\frac{A}{4} + \frac{B}{5} \right)$

27. An emf of 20 V is applied at time $t = 0$ to a circuit containing in series 10 mH inductor and 5 Ω resistor. The ratio of the currents at time $t = \infty$ and at $t = 40$ s is close to : (Take $e^2 = 7.389$)

- (A) 1.06 (B) 0.84
 (C) 1.15 (D) 1.46

28. The electric field of a plane electromagnetic wave is given by

$$\vec{E} = E_0 \frac{\hat{i} + \hat{j}}{\sqrt{2}} \cos(kz + \omega t)$$

At $t = 0$, a positively charged particle is at the point $(x, y, z) =$

$$\left(0, 0, \frac{\pi}{k} \right)$$

If its instantaneous velocity at $(t = 0)$ is $v_0 \hat{k}$, the force acting on it due to the wave is :

- (A) parallel to $\hat{k}$
 (B) parallel to

$$\frac{\hat{i} + \hat{j}}{\sqrt{2}}$$

- (C) antiparallel to

$$\frac{\hat{i} + \hat{j}}{\sqrt{2}}$$

- (D) zero

29. A mass of 10 kg is suspended by a rope of length 4 m, from the ceiling. A force F is applied horizontally at the mid point of the rope such that the top half of the rope makes an angle of 45° with the vertical. Then F equal : (Take $g = 10 \text{ ms}^{-2}$ and the rope to be massless)

- (A) 100 N (B) 75 N
 (C) 90 N (D) 70 N

30. In a Young's double slit experiment, the separation between the slits is 0.15 mm. in the experiment, a source of light of wavelength 589 nm is used and the interference pattern is observed on a screen kept 1.5 m away. The separation between the successive bright fringes on the screen is :

- (A) 4.9 mm (B) 5.9 mm
 (C) 6.9 mm (D) 3.9 mm

31. A particle of mass m and charge q has an initial velocity

$$\vec{v} = v_0 \hat{j}$$

. If an electric field

$$\vec{E} = E_0 \hat{i}$$

and magnetic field

$$\vec{B} = B_0 \hat{i}$$

act on the particle, its speed will double after a time:

- (A) $\frac{3mv_0}{qE_0}$
 (B) $\frac{\sqrt{2} mv_0}{qE_0}$
 (C) $\frac{\sqrt{3} mv_0}{qE_0}$
 (D) $\frac{2mv_0}{qE_0}$

32. An electron (of mass m) and a photon have the same energy E in the range of a few eV. The ratio of the de-Broglie wavelength associated with the electron and the wavelength of the photon is (c = speed of light in vacuum)

- (A) $\frac{1}{c} \left(\frac{2E}{m} \right)^{\frac{1}{2}}$
 (B) $\frac{1}{c} \left(\frac{E}{2m} \right)^{\frac{1}{2}}$
 (C) $\left(\frac{E}{2m} \right)^{\frac{1}{2}}$
 (D) $c(2mE)^{\frac{1}{2}}$

33. A box weight 196 N on a spring balance at the north pole. Its weight recorded on the same balance if it is shifted to the equator is close to (Take $g = 10 \text{ ms}^{-2}$ at the north pole and the radius of the earth = 6400 km) :

- (A) 194.32 N (B) 195.66 N
 (C) 195.32 N (D) 194.66 N

34. The dimension of $\frac{B^2}{2\mu_0}$, where B is magnetic field and μ_0 is the magnetic permeability of vacuum, is :

- (A) ML^2T^{-2} (B) MLT^{-2}
 (C) $\text{ML}^{-1}\text{T}^{-2}$ (D) ML^2T^{-1}

35. An ideal fluid flows (laminar flow) through a pipe of non-uniform diameter. The maximum and minimum diameters of the pipes are 6.4 cm and 4.8 cm, respectively. The ratio of the minimum and the maximum velocities of fluid in this pipe is :

- (A) $\frac{3}{4}$
 (B) $\frac{9}{16}$
 (C) $\frac{\sqrt{3}}{2}$
 (D) $\frac{81}{256}$

36. A planar loop of wire rotates in a uniform magnetic field. Initially at $t = 0$, the plane of the loop is perpendicular to the magnetic field. If it rotates with a period of 10 s about an axis in its plane then the magnitude of induced emf will be maximum and minimum, respectively at :

- (A) 2.5 s and 7.5 s (B) 5.0 s and 10.0 s
 (C) 5.0 s and 7.5 s (D) 2.5 s and 5.0 s

37. An elevator in a building can carry a maximum of 10 persons, with the average mass of each person being 68 kg. The mass of the elevator itself is 920 kg and it moves with a constant speed of 3 m/s. The frictional force opposing the motion is 6000 N. If the elevator is moving up with its full capacity, the power delivered by the motor to the elevator ($g = 10 \text{ m/s}^2$) must be at least :

- (A) 48000 W (B) 62360 W
 (C) 56300 W (D) 66000 W

38. A thin lens made of glass (refractive index = 1.5) of focal length $f = 16$ cm is immersed in a liquid of refractive index 1.42. If its focal length in liquid is f_1 , then the ratio

$$\frac{f_1}{f}$$

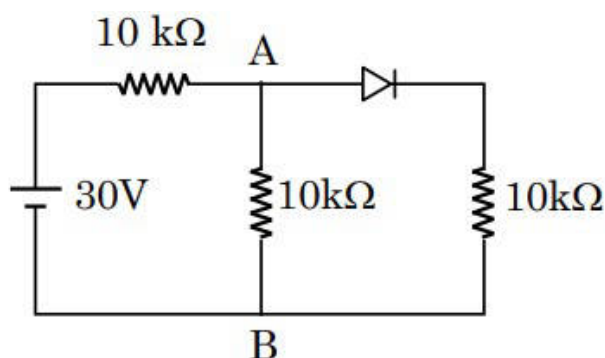
is closest to the integer :

- (A) 17 (B) 1
(C) 9 (D) 5

39. In a building there are 15 bulbs of 45 W, 15 bulbs of 100 W, 15 small fans of 10 W and 2 heaters of 1 kW. The voltage of electric main is 220 V. The minimum fuse capacity (rated value) of the building will be :

- (A) 15 A (B) 20 A
(C) 25 A (D) 10 A

40. In the figure, potential difference between A and B is :



- (A) 10 V (B) 5 V
(C) zero (D) 15 V

41. Under an adiabatic process, the volume of an ideal gas gets doubled. Consequently the mean collision time between the gas molecule changes from τ_1 to τ_2 . If

$$\frac{C_p}{C_v} = \gamma$$

for this gas then a good estimate for

$$\frac{\tau_2}{\tau_1}$$

is given by :

- (A) $(2)^{\frac{1+\gamma}{2}}$
(B) 2
(C) $\left(\frac{1}{2}\right)^{\frac{1+\gamma}{2}}$
(D) $\left(\frac{1}{2}\right)^\gamma$

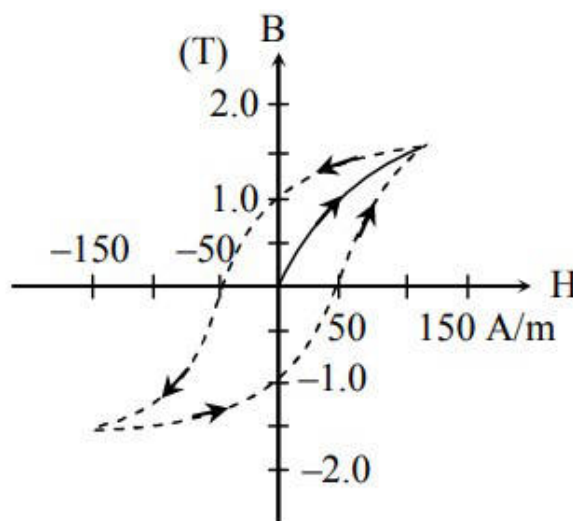
42. The activity of a radioactive sample falls from 700 s^{-1} to 500 s^{-1} in 30 minutes. Its half life is close to:

- (A) 62 min (B) 66 min
(C) 72 min (D) 52 min

43. Two ideal Carnot engines operate in cascade (all heat given up by one engine is used by the other engine to produce work) between temperature, T_1 and T_2 . The temperature of the hot reservoir of the first engine is T_1 and the temperature of the cold reservoir of the second engine is T_2 . T is temperature of the sink of first engine which is also the source for the second which is also the source for the second engine. How is T related to T_1 and T_2 . If both engines perform equal amount of work?

- (A) $T = \frac{2T_1T_2}{T_1 + T_2}$
 (B) $T = \sqrt{T_1T_2}$
 (C) $T = \frac{T_1 + T_2}{2}$
 (D) $T = 0$

44.



The figure gives experimentally measured B vs H variation in a ferromagnetic material. The retentivity, coercivity and saturation, respectively, of the material are :

- (A) 1.0 T, 50 A/m and 1.5 T
 (B) 1.5 T, 50 A/m and 1.0 T
 (C) 1.5 T, 50 A/m and 2.0 T
 (D) 150 A/m, 1.0 T and 1.5 T

45. A stationary observer receives sound from two identical tuning forks, one of which approaches and the other one recedes with the same speed (much less than the speed of sound). The observer hears 2 beats/sec. The oscillation frequency of each tuning fork is $\nu_0 = 1400$ Hz and the velocity of sound in air is 350 m/s. The speed of each tuning fork is close to :

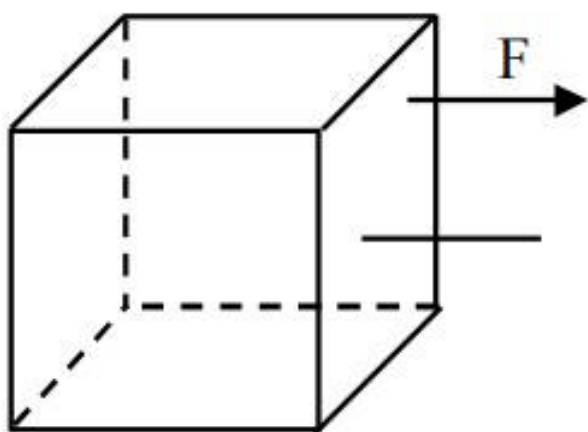
- (A) 1 m/s
 (B) $\frac{1}{8}$ m/s
 (C) $\frac{1}{4}$ m/s
 (D) $\frac{1}{2}$ m/s

46. The sum of two forces $\vec{P}$ and $\vec{Q}$ is $\vec{R}$ such that

$$|\vec{R}| = |\vec{P}|$$

. The angle θ (in degrees) that the resultant of $2\vec{P}$ and $\vec{Q}$ will make with $\vec{Q}$ is , ...

47.



Consider a uniform cubical box of side a on a rough floor that is to be moved by applying minimum possible force F at a point b above its centre of mass (see figure). If the coefficient of friction is $\mu = 0.4$, the maximum possible value of $100 \times$

$$\frac{b}{a}$$

for box not to topple before moving is

48. M grams of steam at 100°C is mixed with 200 g of ice at its melting point in a thermally insulated container. If it produced liquid water at 40°C [heat of vaporization of water is 540 cal/g and heat of fusion of ice is 80 cal/g] the value of M is ____

49. A 60 pF capacitor is fully charged by a 20 V supply. It is then disconnected from the supply and is connected to another uncharged 60 pF capacitor in parallel. The electrostatic energy that is lost in this process by the time the charge is redistributed between them is (in nJ) ____

50. The balancing length for a cell is 560 cm in a potentiometer experiment. When an external resistance of $10\ \Omega$ is connected in parallel to the cell, the balancing length changes by 60 cm. If the internal resistance of the cell is $\frac{N}{10}\ \Omega$, where N is an integer then value of N is

51. Among the statements(a)-(d) the incorrect ones are :

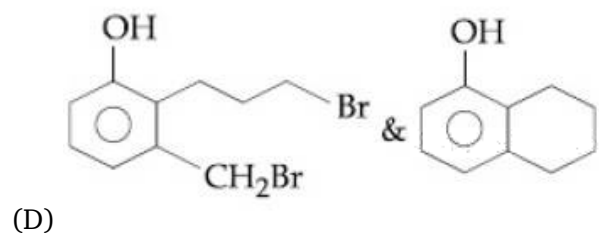
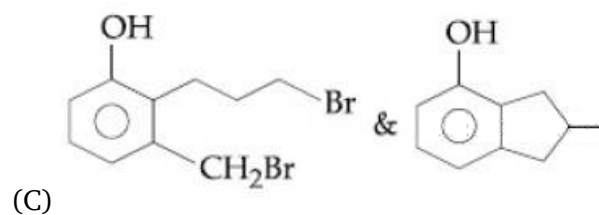
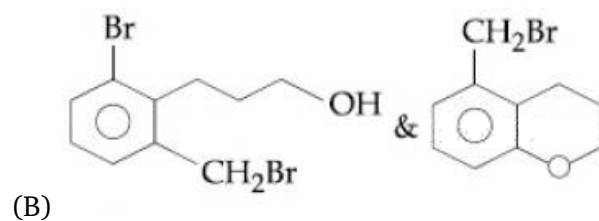
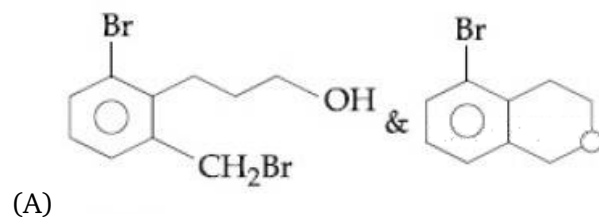
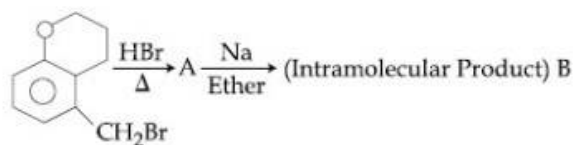
- (a) Octahedral Co(III) complexes with strong fields ligands have very high magnetic moments.
 (b) When $\Delta_0 < P$, the d-electron configuration of Co(III) in an octahedral complex is $t_{eg}^4 e_g^2$
 (c) Wavelength of light absorbed by $[\text{Co(en)}_3]^{3+}$ is lower than that of $[\text{CoF}_6]^{3-}$
 (d) If the Δ_0 for an octahedral complex of Co(III) is $18,000 \text{ cm}^{-1}$, the Δ_t for its tetrahedral complex with the same ligand be $16,000 \text{ cm}^{-1}$

- (A) (a) and (b) only (B) (b) and (c) only
 (C) (c) and (d) only (D) (a) and (d) only

52. Within each pair of elements F & Cl, S & Se, and Li & Na, respectively, the elements that release more energy upon ionization and electron gain are :

- (A) F, S and Li (B) Cl, Se and Na
 (C) Cl, S and Li (D) F, Se and Na

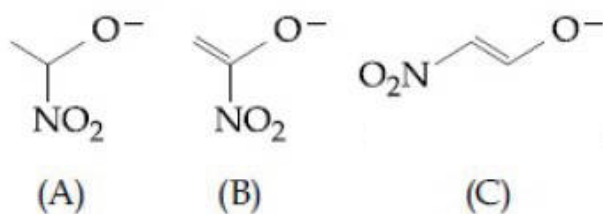
53. In the following reactions sequence, structure of A and B respectively will be :



54. Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non volatile solute are together sealed in a container. Over time :

- | | |
|---|---|
| (A) The volume of the solution increases and the volume of the solvent decreases. | (B) The volume of solution does not change and the volume of the solvent decreases. |
| (C) The volume of the solution and the solvent does not change. | (D) The volume of the solution decreases and the volume of the solvent increases. |

55. The correct order of stability for the following alkoxides is :



- | | |
|---------------------|---------------------|
| (A) (C) > (B) > (A) | (B) (C) > (A) > (B) |
| (C) (B) > (C) > (A) | (D) (B) > (A) > (C) |

56. The bond order and the magnetic characteristics of CN^- are :

- | | |
|---------------------|-----------------------------------|
| (A) 3, paramagnetic | (B) $2\frac{1}{2}$, paramagnetic |
| (C) 3, diamagnetic | (D) $2\frac{1}{2}$, diamagnetic |

57. Which of the following statements is correct ?

- | | |
|---|---|
| (A) Gluconic acid can from cyclic (actal/hemiacetal) structure | (B) Gluconic acid is a partial oxidation product of glucose |
| (C) Gluconic acid is obtained by oxidation of glucose with (HNO_3) | (D) Gluconic acid is a dicarboxylic acid. |

58. The number of possible optical isomers for the complexes MA_2B_2 with sp^3 and dsp^2 hybridized metal atom, respectively, is :

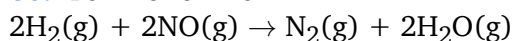
Note : A and B are unidentate neutral and unidentate monoanionic ligands, respectively.

- | | |
|-------------|-------------|
| (A) 0 and 2 | (B) 0 and 0 |
| (C) 0 and 1 | (D) 2 and 2 |

59. The redox reaction among the following is :

- | | |
|--|---|
| (A) reaction of H_2SO_4 with NaOH . | (B) formation of ozone from atmosphere oxygen in the presence of sunlight. |
| (C) combination of dinitrogen with dioxygen at 2000 K | (D) reaction of $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3$ With AgNO_3 |

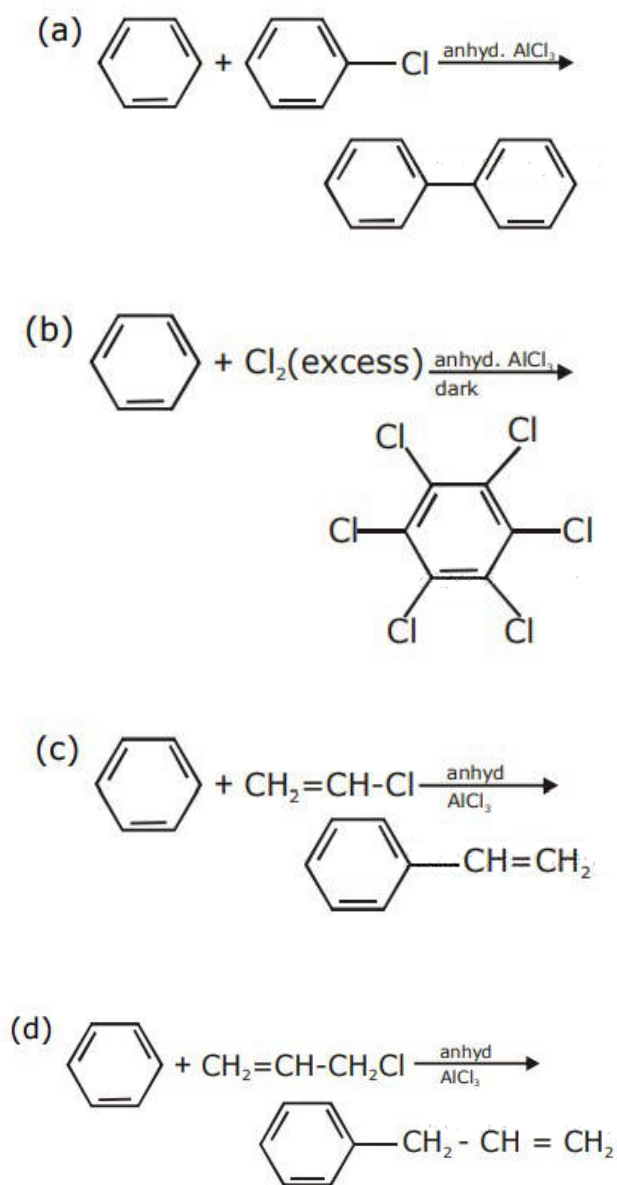
60. For the reaction



the observed rate expression is, $\text{rate} = K_f[\text{NO}]^2[\text{H}_2]$. The rate expression for the reverse reaction is :

- | | |
|---|--|
| (A) $K_b[\text{N}_2][\text{H}_2\text{O}]$ | (B) $K_b[\text{N}_2][\text{H}_2\text{O}]^2/[\text{H}_2]$ |
| (C) $K_b[\text{N}_2][\text{H}_2\text{O}]^2/[\text{NO}]$ | (D) $K_b[\text{N}_2][\text{H}_2\text{O}]^2$ |

61. Consider the following reactions :



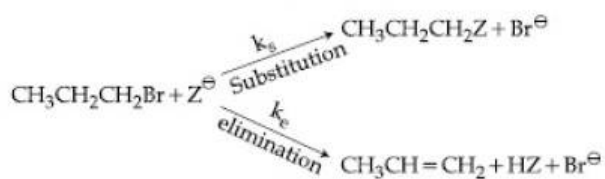
Which of these reactions are possible ?

- (A) (b), (c) and (d) (B) (a) and (b)
 (C) (a) and (d) (D) (b) and (d)

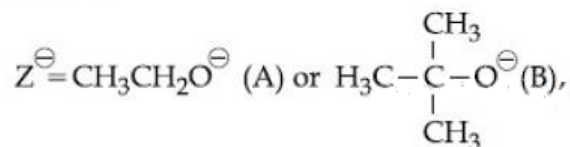
62. The equation that is incorrect is :

- (A) $(\Lambda_m^0)_{KCl} - (\Lambda_m^0)_{NaCl} = (\Lambda_m^0)_{KBr} - (\Lambda_m^0)_{NaBr}$
- (B) $(\Lambda_m^0)_{NaBr} - (\Lambda_m^0)_{NaI} = (\Lambda_m^0)_{KBr} - (\Lambda_m^0)_{NaBr}$
- (C) $(\Lambda_m^0)_{NaBr} - (\Lambda_m^0)_{NaCl} = (\Lambda_m^0)_{KBr} - (\Lambda_m^0)_{KCl}$
- (D) $(\Lambda_m^0)_{H_2O} = (\Lambda_m^0)_{HCl} + (\Lambda_m^0)_{NaOH} - (\Lambda_m^0)_{NaCl}$

63. For the following reactions



where,



K_s and K_e , are respectively, the rate constants for substitution and elimination and

$$\mu = \frac{k_s}{k_e}$$

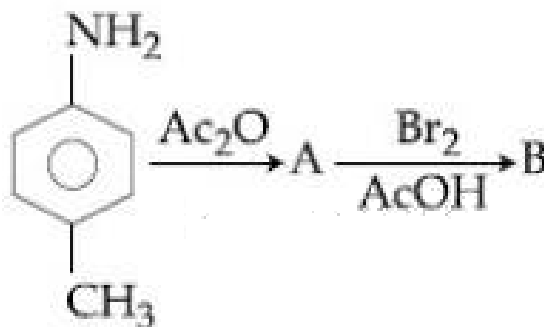
the correct options is

- (A) $\mu_B > \mu_A$
and $K_e(\text{A}) > K_e(\text{B})$
- (B) $\mu_A > \mu_B$
and $K_e(\text{B}) > K_e(\text{A})$
- (C) $\mu_B > \mu_A$
and $K_e(\text{B}) > K_e(\text{A})$
- (D) $\mu_A > \mu_B$
and $K_e(\text{A}) > K_e(\text{B})$

64. A chromatography column, packed with silica gel as stationary phase, was used to separate a mixture of compounds consisting of (A) benzanilide (B) aniline and (C) acetophenone. When the column is eluted with a mixture of solvents, hexane : ethylacetate (20:80), the sequence of obtained compounds is :

- (A) (A), (B) and (C) (B) (B), (A) and (C)
- (C) (C), (A) and (B) (D) (B), (C) and (A)

65. In the following reaction sequence,



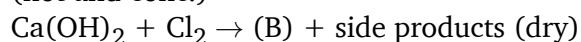
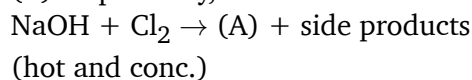
The major product B is :

- (A)
- (B)
- (C)
- (D)

66. The ammonia (NH_3) released on quantitative reaction of 0.6 g urea (NH_2CONH_2) with sodium hydroxide (NaOH) can be neutralized by :

- (A) 200 ml of 0.02 N HCl (B) 100 ml of 0.2 N HCl
(C) 100 ml of 0.1 N HCl (D) 200 ml of 0.4 N HCl

67. In the following reaction, products (A) and (B) respectively, are :



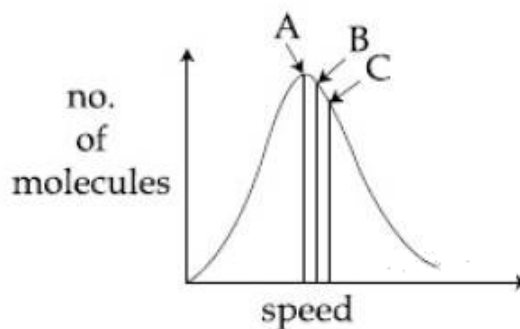
- (A) NaOCl and Ca(OCl)_2 (B) NaClO_3 and $\text{Ca(ClO}_3)_2$
(C) NaOCl and $\text{Ca(ClO}_3)_2$ (D) NaClO_3 and Ca(OCl)_2

68. Among the statements (a) - (d), the correct ones are :

- (a) Decomposition of hydrogen peroxide gives dioxygen.
(b) Like hydrogen peroxide, compounds, such as KClO_3 , $\text{Pb(NO}_3)_2$ and NaNO_3 when heated liberate dioxygen.
(c) 2-Ethylanthraquinone is useful for the industrial preparation of hydrogen peroxide.
(d) Hydrogen peroxide is used for the manufacture of sodium perborate.

- (A) (a), (b), (c) and (d) (B) (a) and (c) only
(C) (a), (b) and (c) only (D) (a), (c) and (d) only

69. Identify the correct labels of A, B and C in the following graph from the options given below :



Root mean square speed (V_{rms}); most probable speed (V_{mp}); Average speed (V_{av})

- (A) A - V_{av} ; B - V_{rms} ; C - V_{mp} (B) A - V_{rms} ; B - V_{mp} ; C - V_{av}
(C) A - V_{mp} ; B - V_{av} ; C - V_{rms} (D) A - V_{mp} ; B - V_{rms} ; C - V_{av}

70. The refining method used when the metal and the impurities have low and high melting temperatures, respectively, is :

- (A) liquation (B) vapour phase refining
(C) distillation (D) zone refining

Chemistry - Section B · Numerical Value Questions

71. The flocculation value of HCl for arsenic sulphide sol.

is 30 m mol L^{-1} . If H_2SO_4 is used for the flocculation of arsenic sulphide, the amount in grams, of H_2SO_4 in 250 ml required for the above purposed is _____.

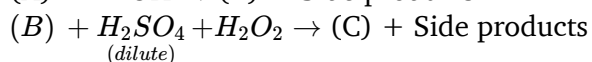
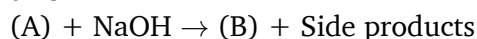
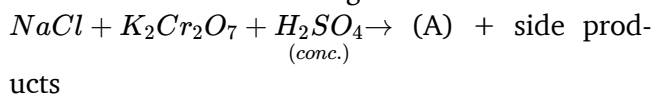
(molecular mass of $\text{H}_2\text{SO}_4 = 98 \text{ g/mol}$)

72. The standard heat of formation ($\Delta_f H_{298}^0$) of ethane (in kJ/mol), if the heat of combustion of ethane, hydrogen and graphite are - 1560, -393.5 and -286 KJ/mol, respectively is :

73. 3 g of acetic acid is added to 250 mL of 0.1 M HCL and the solution made up to 500 mL. To 20 mL of this solutions $\frac{1}{2}$ mL of 5 M NaOH is added. The pH of the solution is _____.

[Given : pKa of acetic acid = 4.75, molar mass of acetic of acid = 60 g/mol, $\log 3 = 0.4771$] Neglect any changes in volume.

74. Consider the following reactions :



The sum of the total number of atoms in one molecule each of (A) and (B) and (C) is

75. The number of sp^2 hybridised carbons present in "Aspartame" is

- End of Question Paper -