

JEE Main 2020 Paper 1 (B.E./B.Tech) 7 January 2020 Shift 1 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 1. 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. If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12, then the length of its latus rectum is :

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

2. Total number of 6-digit numbers in which only and all the five digits 1, 3, 5, 7 and 9 appear, is :

- (A) $\frac{5}{2}(6!)$
 (B) $6!$
 (C) 5^6
 (D) $\frac{1}{2}(6!)$

3. If

$$y(\alpha) = \sqrt{2\left(\frac{\tan \alpha + \cot \alpha}{1 + \tan^2 \alpha}\right) + \frac{1}{\sin^2 \alpha}}, \alpha \in \left(\frac{3\pi}{4}, \pi\right)$$

$$\frac{dy}{d\alpha} \text{ at } \alpha = \frac{5\pi}{6} \text{ is}$$

:

- (A) 4
 (B) -4
 (C) $\frac{4}{3}$
 (D) - $\frac{1}{4}$

4. Let α be a root of the equation $x^2 + x + 1 = 0$ and the matrix $A =$

$$\frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha^4 \end{bmatrix}$$

then the matrix A^{31} is equal to

- (A) A^2 (B) A
 (C) I_3 (D) A^3

5. If $y = y(x)$ is the solution of the differential equation,

$$e^y \left(\frac{dy}{dx} - 1 \right) = e^x$$

such that $y(0) = 0$, then $y(1)$ is equal to:

- (A) $2 + \log_e 2$ (B) $\log_e 2$
 (C) $1 + \log_e 2$ (D) $2e$

6. An unbiased coin is tossed 5 times. Suppose that a variable X is assigned the value of k when k consecutive heads are obtained for $k = 3, 4, 5$, otherwise X takes the value -1. Then the expected value of X , is :

- (A) $-\frac{3}{16}$
 (B) $-\frac{1}{8}$
 (C) $\frac{1}{8}$
 (D) $\frac{3}{16}$

7. Five numbers are in A.P whose sum is 25 and product is 2520. If one of these five numbers is $-\frac{1}{2}$, then the greatest number amongst them is:

- (A) $\frac{21}{2}$
 (B) 27
 (C) 7
 (D) 16

8. The greatest positive integer k, for which $49^k + 1$ is a factor of the sum $49^{125} + 49^{124} + \dots + 49^2 + 49 + 1$, is:

- (A) 32 (B) 60
 (C) 63 (D) 65

9. If

$$\operatorname{Re}\left(\frac{z-1}{2z+i}\right) = 1$$

, where $z = x + iy$, then the point (x, y) lies on a :

- (A) straight line whose slope is $\frac{3}{2}$
 (B) straight line whose slope is $-\frac{2}{3}$
 (C) circle whose diameter is $\frac{\sqrt{5}}{2}$
 (D) circle whose centre is at $\left(-\frac{1}{2}, -\frac{3}{2}\right)$

10. Let $x^k + y^k = a^k$, ($a, k > 0$) and

$$\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$$

, then k is:

- (A) $\frac{1}{3}$
 (B) $\frac{2}{3}$
 (C) $\frac{4}{3}$
 (D) $\frac{3}{2}$

11. If $f(a + b + 1 - x) = f(x)$, for all x, where a and b are fixed positive real numbers, then

$$\frac{1}{a+b} \int_a^b x(f(x) + f(x+1)) dx$$

is equal to:

- (A) $\int_{a-1}^{b-1} f(x+1) dx$
 (B) $\int_{a+1}^{b+1} f(x+1) dx$
 (C) $\int_{a-1}^{b-1} f(x) dx$
 (D) $\int_{a+1}^{b+1} f(x) dx$

12. The area of the region, enclosed by the circle $x^2 + y^2 = 2$ which is not common to the region bounded by the parabola $y^2 = x$ and the straight line $y = x$, is:

- (A) $\frac{1}{6}(24\pi - 1)$
 (B) $\frac{1}{3}(12\pi - 1)$
 (C) $\frac{1}{3}(6\pi - 1)$
 (D) $\frac{1}{6}(12\pi - 1)$

13. If the system of linear equations

$$2x + 2ay + az = 0$$

$$2x + 3by + bz = 0$$

$$2x + 4cy + cz = 0,$$

where $a, b, c \in \mathbb{R}$ are non-zero distinct; has a non-zero solution, then:

- (A) $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P.
 (B) $a + b + c = 0$
 (C) a, b, c are in G.P.
 (D) a, b, c are in A.P.

14. Let α and β be two real roots of the equation $(k + 1)\tan^2 x - \sqrt{2} \cdot \lambda \tan x = (1 - k)$, where $k(\neq -1)$ and λ are real numbers. if $\tan^2(\alpha + \beta) = 50$, then a value of λ is:

- (A) $5\sqrt{2}$ (B) 10
(C) 5 (D) $10\sqrt{2}$

15. A vector

$$\vec{a} = \alpha \hat{i} + 2\hat{j} + \beta \hat{k} (\alpha, \beta \in R)$$

lies in the plane of the vectors,

$$\vec{b} = \hat{i} + \hat{j}$$

and

$$\vec{c} = \hat{i} - \hat{j} + 4\hat{k}$$

. If $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then:

- (A) $\vec{a} \cdot \hat{i} + 3 = 0$
(B) $\vec{a} \cdot \hat{k} - 4 = 0$
(C) $\vec{a} \cdot \hat{i} + 1 = 0$
(D) $\vec{a} \cdot \hat{k} + 2 = 0$

16. If $g(x) = x^2 + x - 1$ and $(g \circ f)(x) = 4x^2 - 10x + 5$, then f

$$\left(\frac{5}{4}\right)$$

is equal to:

- (A) $\frac{1}{2}$
(B) $\frac{3}{2}$
(C) - $\frac{1}{2}$
(D) - $\frac{3}{2}$

17. The logical statement $(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$ is equivalent to :

- (A) q (B) $\sim p$
(C) p (D) $\sim q$

18. Let P be a plane passing through the points (2, 1, 0), (4, 1, 1) and (5, 0, 1) and R be any point (2, 1, 6). Then the image of R in the plane P is :

- (A) (4, 3, 2) (B) (6, 5, -2)
(C) (3, 4, -2) (D) (6, 5, 2)

19. If $y = mx + 4$ is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then b is equal to :

- (A) -128 (B) 128
(C) -64 (D) -32

20. Let the function, $f: [-7, 0] \rightarrow R$ be continuous on $[-7, 0]$ and differentiable on $(-7, 0)$. If $f(-7) = -3$ and $f'(x) \leq 2$, for all $x \in (-7, 0)$, then for all such functions f , $f(-1) + f(0)$ lies in the interval:

- (A) $[-6, 20]$
(B) $(-\infty, 20]$
(C) $[-3, 11]$
(D) $(-\infty, 11]$

21. Let A(1, 0), B(6, 2) and C

$$\left(\frac{3}{2}, 6\right)$$

be the vertices of a triangle ABC. If P is a Point inside the triangle ABC such that the triangles APC, APB and BPC have equal areas, then the length of the line segment PQ, where Q is the point

$$\left(-\frac{7}{6}, -\frac{1}{3}\right)$$

, is _____.

- 22.

$$\lim_{x \rightarrow 2} \frac{3^x + 3^{3-x} - 12}{3^{-x/2} - 3^{1-x}}$$

is equal to _____.

23. If the variance of the first n natural numbers is 10 and the variance of the first m even natural numbers is 16, then m + n is equal to _____.

24. Let S be the set of points where the function, $f(x) = |2 - |x - 3||$, $x \in \mathbb{R}$ is not differentiable. Then

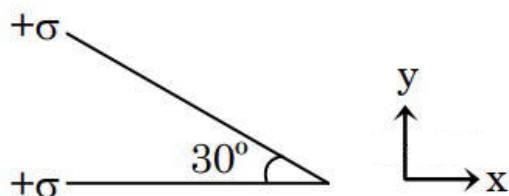
$$\sum_{x \in S} f(f(x))$$

is equal to _____.

25. If the sum of the coefficients of all even powers of x in the product

$(1 + x + x^2 + \dots + x^{2n})(1 - x + x^2 - x^3 + \dots + x^{2n})$ is 61, then n is equal to _____.

26. Two infinite planes each with uniform surface charge density σ are kept in such a way that the angle between them is 30° . The electric field in the region shown between them is given by :



- (A) $\frac{\sigma}{\epsilon_0} \left[\left(1 + \frac{\sqrt{3}}{2} \right) \hat{y} + \frac{\hat{x}}{2} \right]$
 (B) $\frac{\sigma}{2\epsilon_0} \left[(1 + \sqrt{3}) \hat{y} + \frac{\hat{x}}{2} \right]$
 (C) $\frac{\sigma}{2\epsilon_0} \left[(1 + \sqrt{3}) \hat{y} - \frac{\hat{x}}{2} \right]$
 (D) $\frac{\sigma}{2\epsilon_0} \left[\left(1 - \frac{\sqrt{3}}{2} \right) \hat{y} - \frac{\hat{x}}{2} \right]$

27. A litre of dry air at STP expands adiabatically to a volume of 3 litres. If $\gamma = 1.40$, the work done by air is : ($3^{1.4} = 4.6555$) [Take air to be an ideal gas]

- (A) 60.7 J (B) 100.8 J
 (C) 90.5 J (D) 48 J

28. The time period of revolution of electron in its ground state orbit in a hydrogen atom is 1.6×10^{-16} s. The frequency of revolution of the electron in its first excited state (in s^{-1}) is :

- (A) 5.6×10^{12} (B) 1.6×10^{14}
 (C) 7.8×10^{14} (D) 6.2×10^{15}

29. A LCR circuit behaves like a damped harmonic oscillator. Comparing it with a physical spring-mass damped oscillator having damping constant 'b', the correct equivalence would be:

(A) $L \leftrightarrow k, C \leftrightarrow b, R \leftrightarrow m$

(B) $L \leftrightarrow m, C \leftrightarrow k, R \leftrightarrow b$

(C) $L \leftrightarrow m, C \leftrightarrow$

$\frac{1}{k}, R \leftrightarrow b$

(D) $L \leftrightarrow$

$\frac{1}{b}, C \leftrightarrow$

$\frac{1}{m}, R \leftrightarrow$

$\frac{1}{k}$

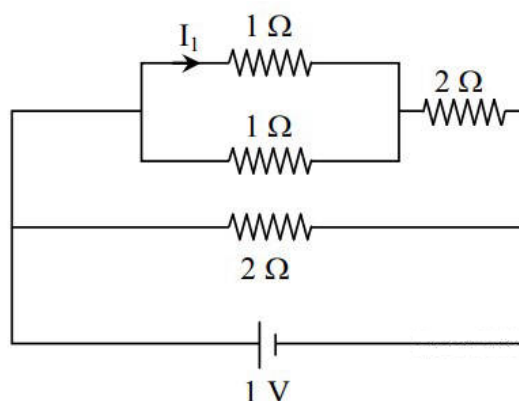
30. If the magnetic field in a plane electromagnetic wave is given by

$\vec{B} = 3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t) \hat{j}$ T, then what will be expression for electric field ?

(A) $\vec{E} = (9 \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)) \hat{k}$ V/m
 (B) $\vec{E} = (60 \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)) \hat{k}$ V/m

(C) $\vec{E} = (3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)) \hat{i}$ V/m
 (D) $\vec{E} = (3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)) \hat{j}$ V/m

31. The current I_1 (in A) flowing through 1Ω resistor in the following circuit is :



- (A) 0.4 (B) 0.25
 (C) 0.2 (D) 0.5

32.



A parallel plate capacitor has plates of area A separated by distance ' d ' between them. It is filled with a dielectric which has a dielectric constant that varies as $k(x) = K(1 + \alpha x)$ where ' x ' is the distance measured from one of the plates. If $(\alpha d) \ll 1$, the total capacitance of the system is best given by the expression :

- (A) $\frac{A \epsilon_0 K}{d} \left(1 + \left(\frac{\alpha d}{2} \right)^2 \right)$
- (B) $\frac{A \epsilon_0 K}{d} \left(1 + \frac{\alpha d}{2} \right)$
- (C) $\frac{A \epsilon_0 K}{d} \left(1 + \frac{\alpha^2 d^2}{2} \right)$
- (D) $\frac{A \epsilon_0 K}{d} (1 + \alpha d)$

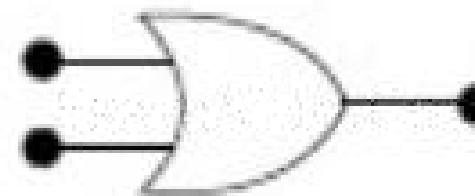
33. Which of the following gives a reversible operation?



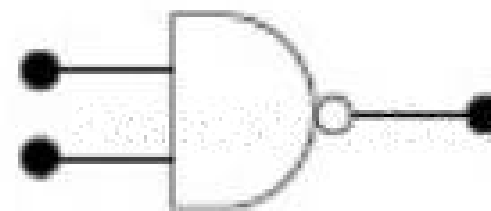
(A)



(B)

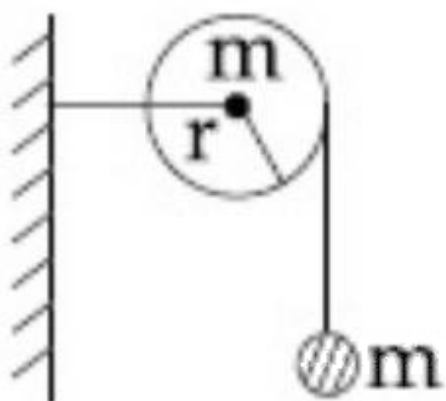


(C)



(D)

34.



As shown in the figure, a bob of mass m is tied by a massless string whose other end portion is wound on a fly wheel (disc) of radius r and mass m . When released from rest the bob starts falling vertically. When it has covered a distance of h , the angular speed of the wheel will be:

- (A) $r\sqrt{\frac{3}{2gh}}$
 (B) $r\sqrt{\frac{3}{4gh}}$
 (C) $\frac{1}{r}\sqrt{\frac{4gh}{3}}$
 (D) $\frac{1}{r}\sqrt{\frac{2gh}{3}}$

35. A satellite of mass m is launched vertically upwards with an initial speed u from the surface of the earth. After it reaches height R (R = radius of the earth), it ejects a rocket of mass $\frac{m}{10}$ so that subsequently the satellite moves in a circular orbit. The kinetic energy of the rocket is (G is the gravitational constant; M is the mass of the earth) :

- (A) $\frac{3m}{8}\left(u + \sqrt{\frac{5GM}{6R}}\right)^2$
 (B) $\frac{m}{20}\left(u^2 + \frac{113}{100}\frac{GM}{R}\right)$
 (C) $5m\left(u^2 - \frac{119}{100}\frac{GM}{R}\right)$
 (D) $\frac{m}{20}\left(u - \sqrt{\frac{2GM}{3R}}\right)^2$

36. If we need a magnification of 375 from a compound microscope of tube length 150 mm and an objective of focal length 5 mm, the focal length of the eye-piece, should be close to :

- (A) 22 mm (B) 12 mm
 (C) 33 mm (D) 2 mm

37. Two moles of an ideal gas with

$$\frac{C_P}{C_V} = \frac{5}{3}$$

are mixed with 3 moles of another ideal gas with

$$\frac{C_P}{C_V} = \frac{4}{3}$$

. The value of $\frac{C_P}{C_V}$ for the mixture is :

- (A) 1.50 (B) 1.45
 (C) 1.47 (D) 1.42

38. Consider a circular coil of wire carrying constant current I , forming a magnetic dipole. The magnetic flux through an infinite plane that contains the circular coil and excluding the circular coil area is given by ϕ_i . The magnetic flux through the area of the circular coil area is given by ϕ_0 . Which of the following option is correct?

- (A) $\phi_i = \phi_0$
 (B) $\phi_i < \phi_0$
 (C) $\phi_i > \phi_0$
 (D) $\phi_i = -\phi_0$

39. A polarizer - analyser set is adjusted such that the intensity of light coming out of the analyser is just 10% of the original intensity. Assuming that the polarizer - analyser set does not absorb any light, the angle by which the analyser need to be rotated further to reduce the output intensity to be zero, is :

- (A) 71.6° (B) 90°
 (C) 18.4° (D) 45°

40. A 60 HP electric motor lifts an elevator having a maximum total load capacity of 2000 kg. If the frictional force on the elevator is 4000 N, the speed of the elevator at full load is close to :

(1 HP = 746 W, $g = 10 \text{ ms}^{-2}$)

- (A) 1.5 ms^{-1} (B) 1.7 ms^{-1}
(C) 2.0 ms^{-1} (D) 1.9 ms^{-1}

41. A long solenoid of radius R carries a time (t) - dependent current

$I(t) = I_0 t(1 - t)$. A ring of radius $2R$ is placed coaxially near its middle. During the time interval $0 \leq t \leq 1$, the induced current (I_R) and the induced EMF (V_R) in the ring change as :

- | | |
|--|--|
| (A) Direction of I_R remains unchanged and V_R is zero at $t = 0.25$ | (B) Direction of I_R remains unchanged and V_R is maximum at $t = 0.5$ |
| (C) At $t = 0.25$ direction of I_R reverses and V_R is maximum | (D) At $t = 0.5$ direction of I_R reverses and V_R is zero |

42. Visible light of wavelength $6000 \times 10^{-8} \text{ cm}$ falls normally on a single slit and produces a diffraction pattern. It is found that the second diffraction minimum is at 60° from the central maximum. If the first minimum is produced at θ_1 , then θ_1 is close to :

- (A) 45° (B) 30°
(C) 25° (D) 20°

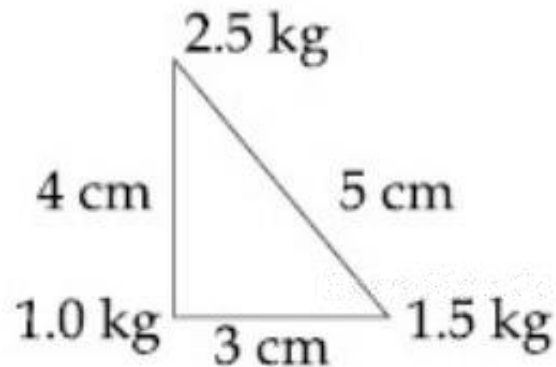
43. Speed of a transverse wave on a straight wire (mass 6.0 g, length 60 cm and area of cross-section 1.0 mm^2) is 90 ms^{-1} . If the Young's modulus of wire is $16 \times 10^{11} \text{ Nm}^{-2}$, the extension of wire over its natural length is :

- (A) 0.03 mm (B) 0.04 mm
(C) 0.02 mm (D) 0.01 mm

44. The radius of gyration of a uniform rod of length l , about an axis passing through a point $\frac{l}{4}$ away from the centre of the rod, and perpendicular to it, is :

- (A) $\frac{1}{8}l$
(B) $\frac{1}{4}l$
(C) $\sqrt{\frac{7}{48}}l$
(D) $\sqrt{\frac{3}{8}}l$

45. Three point particles of masses 1.0 kg, 1.5 kg and 2.5 kg are placed at three corners of a right angle triangle of sides 4.0 cm, 3.0 cm and 5.0 cm as shown in the figure. The center of mass of the system is at a point:



- | | |
|---|---|
| (A) 2.0 cm right and 0.9 cm above 1 kg mass | (B) 0.9 cm right and 2.0 cm above 1 kg mass |
| (C) 0.6 cm right and 2.0 cm above 1 kg mass | (D) 1.5 cm right and 1.2 cm above 1 kg mass |

46. A loop ABCDEFA of straight edges has six corner points A(0, 0, 0), B(5, 0, 0), C(5, 5, 0), D(0, 5, 0), E(0, 5, 5) and F(0, 0, 5). The magnetic field in this region is

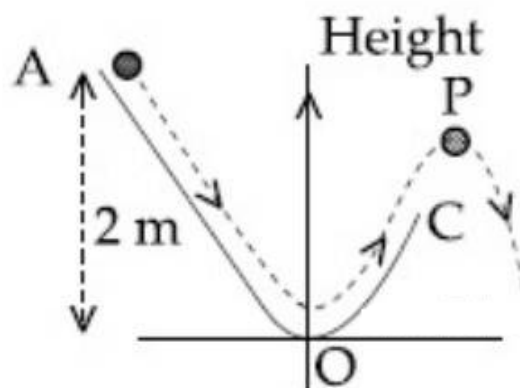
$$\vec{B} = (3\hat{i} + 4\hat{k})T$$

. The quantity of flux through the loop ABCDEFA (in Wb) is _____.

47. A beam of electromagnetic radiation of intensity $6.4 \times 10^{-5} \text{ W/cm}^2$ is comprised of wavelength, $\lambda = 310 \text{ nm}$. It falls normally on a metal (work function $\phi = 2\text{ eV}$) of surface area of 1 cm^2 . If one in 10^3 photons ejects an electron, total number of electrons ejected in 1 s is 10^x . ($hc = 1240 \text{ eVnm}$, $1\text{ eV} = 1.6 \times 10^{-19} \text{ J}$), then x is _____.

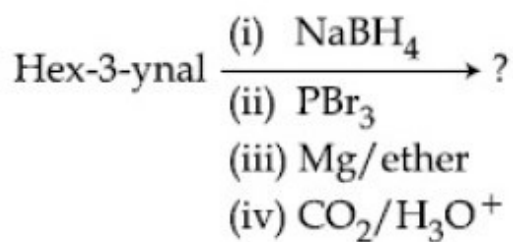
48. A non-isotropic solid metal cube has coefficients of linear expansion as : $5 \times 10^{-5}/^\circ\text{C}$ along the x-axis and $5 \times 10^{-6}/^\circ\text{C}$ along the y and the z-axis. If the coefficient of volume expansion of the solid is $C \times 10^{-6}/^\circ\text{C}$ then the value of C is _____.

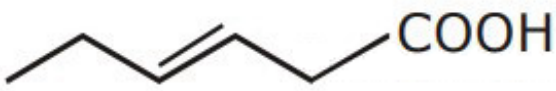
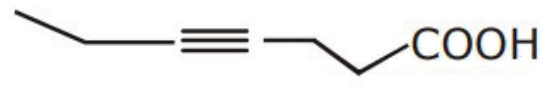
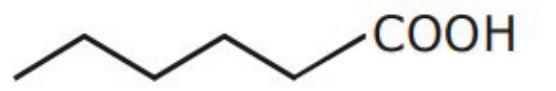
49. A particle ($m = 1 \text{ kg}$) slides down a frictionless track (AOC) starting from rest at a point A (height 2 m). After reaching C, the particle continues to move freely in air as a projectile. When it reaching its highest point P (height 1 m), the kinetic energy of the particle (in J) is : (Figure drawn is schematic and not to scale; take $g = 10 \text{ ms}^{-2}$)



50. A Carnot engine operates between two reservoirs of temperatures 900 K and 300 K. The engine performs 1200 J of work per cycle. The heat energy (in J) delivered by the engine to the low temperature reservoir, in a cycle, is _____.

51. What is the product of following reaction ?



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

52. At 35°C, the vapour pressure of CS₂ is 512 mm. Hg and that of acetone is 344 mm Hg. A solution of CS₂ in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is :

- (A) CS₂ and acetone are less attracted to each other than to themselves. (B) a mixture of 100 ml. CS₂ and 100 ml. acetone has a volume < 200 ml.
- (C) Heat must be absorbed in order to produce the solution 35°C (D) Raoult's law is not obeyed by this system.

53. The number of orbitals associated with quantum number $n = 5$, $m_s = +\frac{1}{2}$ is :

- (A) 11 (B) 25
(C) 15 (D) 50

54. Given that the standard potentials (E°) of Cu²⁺/Cu and Cu⁺/Cu are 0.34 V and 0.522 V respectively, the E° of Cu²⁺/Cu⁺ :

- (A) - 0.182 V (B) - 0.158 V
(C) 0.182 V (D) +0.158 V

55. Match the following :

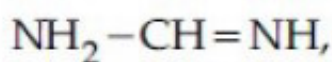
- (i) Riboflavin (a) Beriberi
(ii) Thiamine (b) Scurvy
(iii) Pyridoxine (c) Cheliosis
(iv) Ascorbic acid (d) Convulsions

- (A) (i)-(c), (ii)-(d), (iii)-(a), (iv)-(b) (B) (i)-(d), (ii)-(b), (iii)-(a), (iv)-(c)
(C) (i)-c, (ii)-(a), (iii)-(d), (iv)-(b) (D) (i)-(a), (ii)-(d), (iii)-(c), (iv)-(b)

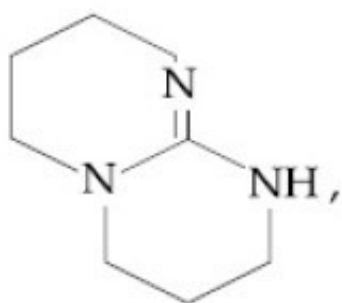
56. The relative strength of interionic/intermolecular forces in decreasing order is :

- (A) dipole-dipole >
 ion-dipole >
 ion-ion
- (B) ion-dipole >
 dipole-dipole >
 ion-ion
- (C) ion-dipole >
 ion-ion >
 dipole-dipole
- (D) ion-ion >
 ion-dipole >
 dipole-dipole

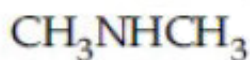
57. The increasing order to P_{kb} for the following compounds will be :



(A)



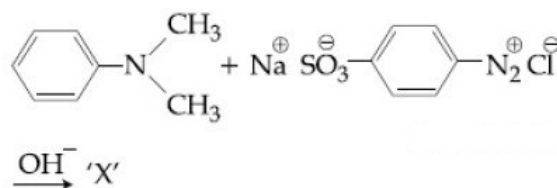
(B)



(C)

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

58. Consider the following reaction :



The product 'X' is used :

- (A) as food grade colourant (B) in acid base titration as an indicator.
 (C) in laboratory test for phenols (D) in protein estimation as an alternative to ninhydrin.

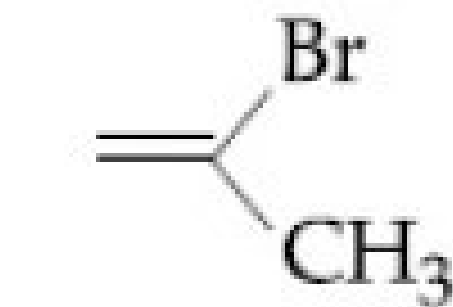
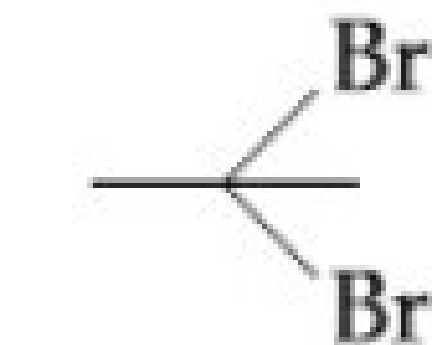
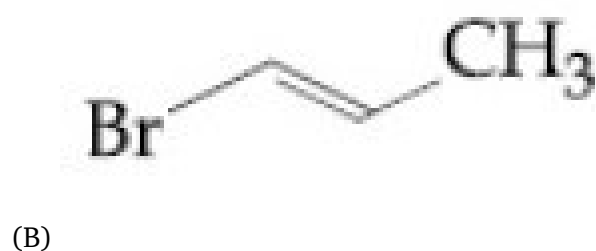
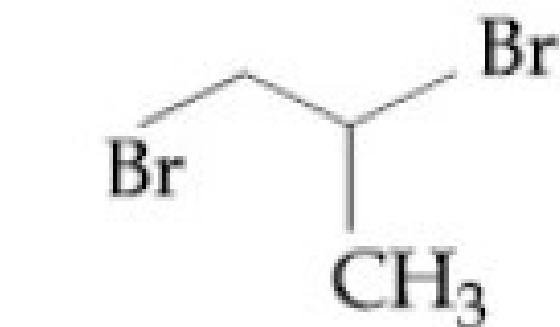
59. The dipole of CCl_4 , CHCl_3 and CH_4 are in the order :

- (A) $\text{CCl}_4 < \text{CH}_4 < \text{CHCl}_3$ (B) $\text{CH}_4 = \text{CCl}_4 < \text{CHCl}_3$
 (C) $\text{CH}_4 < \text{CCl}_4 < \text{CHCl}_3$ (D) $\text{CHCl}_3 < \text{CH}_4 = \text{CCl}_4$

60. The theory that can completely/properly explain the nature of bonding in $[\text{Ni}(\text{Co})_4]$ is :

- (A) Wemer's theory (B) Valence bond theory
 (C) Crystal field theory (D) Molecular orbital theory

61. 1-methyl ethylene oxide when treated with an excess of HBr produces :



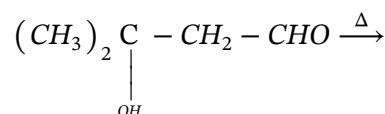
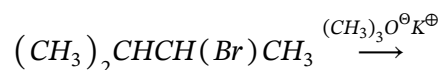
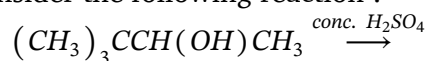
62. The electron gain enthalpy (in KJ/mol) of fluorine, chlorine, bromine and iodine, respectively are:

- (A) -296, -325, -333 and -349 (B) 349, -333, -325 and -296
(C) -333, -349, -325 and -296 (D) -333, -325, -349 and -296

63. Amongst the following statements, that which was not proposed by Dalton was :

- (A) Matter consists of indivisible atoms all the atoms of a given element have. (B) Chemical reactions involve reorganization of atoms. These are neither created nor destroyed in a chemical reaction.
(C) When gases combine or reproduced in a chemical reaction they do so in a simple ratio by volume provided all gases are the same T & P. (D) Identical properties including identical mass. Atoms of different element differ in mass.

64. Consider the following reaction :



Which of these reaction(s) will not produce Saytzeff product ?

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

65. Oxidation number of potassium in K_2O , K_2O_2 and KO_2 respectively is :

- (A) +1, +2 and + 4
(B) +1, +1 and + 1
(C) +2, +1 and

$$+\frac{1}{2}$$

- (D) +1, +4, and +2

66. The atomic radius of Ag is closed to :

- (A) Au (B) Cu
(C) Hg (D) Ni

67. A solution of m-chloronailimne, m-chlorophenol and m-chlorobenzoic acid in ethyl acetate was extracted initially with a saturated solution of $NaHCO_3$ to give fraction A. The left over organic phase was extracted with dilute NaOH solution to give fraction B. The final organic layer was labelled as fraction C. Fractions A,B and C, contain respectively :

- (A) m-chlorobenzoic acid, m-chloroaniline and m-chlorophenol. (B) m-chlorobenzoic acid, m-chlorophenol and m-chloroaniline.
(C) m-chlorophenol, m-chlorobenzoic acid and m-chloroniline. (D) m-chloroaniline m-chlorobenzoic acid and m-chlorophenol.

68. The IUPAC name of complex $[Pt(NH_3)_2Cl(NH_2CH_3)]Cl$ is:

- (A) Diamminechlorido (methanamine) platinum(II)chloride.
(B) Biammine (methanamine)chlorido platinum(II)chloride.
(C) Diamminechlorido (amminomethane) platinum(II) chloride.
(D) Diammine (methanamine) chlorido platinum(II)Chloride.

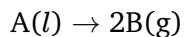
69. In comparison to the zeolite process for the removal of permanent hardness, the synthetic resins method is :

- (A) less efficient as the resins cannot be regenerated. (B) more efficient as it can exchange only cations.
(C) more efficient as it can exchange both cations as well as anions. (D) less efficient as it exchanges only anions.

70. The purest form of commercial iron is :

- (A) pig iron (B) wrought iron
(C) cast iron (D) scrap iron and pig iron

71. For the reaction :



$$\Delta U = 2.1 \text{ kcal}, \Delta S = 20 \text{ cal K}^{-1}$$

at 300 K

Hence ΔG in kcal is :

72. During the nuclear explosion, one of the products is ^{90}Sr with half life of 6.93 years. If $1 \mu\text{g}$ of ^{90}Sr was absorbed in the bones of newly born baby in place of Ca, how much time, in years, is required to reduce much time, in year, is required to reduce it by 90% if it not lost metabolically.

73. Chlorine reacts with hot and concentrated NaOH and produces compounds (X) and (Y). Compound (X) gives white precipitate with silver nitrate solution. The average bond order between Cl and O atoms in (Y) is.

74. Two solutions, A and B, each of 100L was made by dissolving 4g of NaOH and 9.8 g of H_2SO_4 in water, respectively. The pH of the resultant solution obtained from mixing 40L of solution A and 10L of solution B is :

75. The number of chiral carbons in chloramphenicol is

- End of Question Paper -