

JEE Main 2020 Paper 1 (B.E./B.Tech) 8 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 8 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. If

$$A = \begin{pmatrix} 2 & 2 \\ 9 & 4 \end{pmatrix}$$

and

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

then $10A^{-1}$ is equal to :

- (A) $6I - A$ (B) $4I - A$
(C) $A - 6I$ (D) $A - 4I$

2. The mean and variance of 20 observations are found to be 10 and 4, respectively. On rechecking, it was found that an observation 9 was incorrect and the correct observation was 11. Then the correct variance is

- (A) 3.98 (B) 3.99
(C) 4.01 (D) 4.02

3. Let A and B be two events such that the probability that exactly one of them occurs is $\frac{2}{5}$ and the probability that A or B occurs is $\frac{1}{2}$, then the probability of both of them occur together is :

- (A) 0.20 (B) 0.02
(C) 0.01 (D) 0.10

4. Let

$$\alpha = \frac{-1 + i\sqrt{3}}{2}$$

If

$$a = (1 + \alpha) \sum_{k=0}^{100} \alpha^{2k}$$

and

$$b = \sum_{k=0}^{100} \alpha^{3k}$$

, then a and b are the roots of the quadratic equation :

- (A) $x^2 + 101x + 100 = 0$ (B) $x^2 + 102x + 101 = 0$
(C) $x^2 - 102x + 101 = 0$ (D) $x^2 - 101x + 100 = 0$

5. Let S be the set of all real roots of the equation,

$$3^x(3^x - 1) + 2 = |3^x - 1| + |3^x - 2|. \text{ Then } S :$$

- (A) contains exactly two elements. (B) is an empty set.
(C) is a singleton. (D) contains at least four elements.

6. If the 10th term of an A.P is $\frac{1}{20}$ and its 20th term is $\frac{1}{10}$, then the sum of its first 200 terms is

- (A) 100
(B) $100\frac{1}{2}$
(C) $50\frac{1}{4}$
(D) 50

7. Let S be the set of all functions $f : [0,1] \rightarrow \mathbb{R}$, which are continuous on $[0,1]$ and differentiable on $(0,1)$. Then for every f in S, there exists a $c \in (0,1)$, depending on f , such that

- (A) $|f(c) - f(1)| < |f'(c)|$
(B) $|f(c) + f(1)| < (1 + c) |f'(c)|$
(C) $|f(c) - f(1)| < (1 - c) |f'(c)|$
(D) None

8. The system of linear equations

$$\lambda x + 2y + 2z = 5$$

$$2\lambda x + 3y + 5z = 8$$

$$4x + \lambda y + 6z = 10$$
 has

- (A) a unique solution when $\lambda = -8$ (B) no solution when $\lambda = 2$
(C) infinitely many solutions when $\lambda = 2$ (D) no solution when $\lambda = 8$

9. If α and β be the coefficients of x^4 and x^2 respectively in the expansion of

$$(x + \sqrt{x^2 - 1})^6 + (x - \sqrt{x^2 - 1})^6, \text{ then}$$

- (A) $\alpha + \beta = 60$
(B) $\alpha - \beta = 60$
(C) $\alpha + \beta = -30$
(D) $\alpha - \beta = -132$

10.

$$\lim_{x \rightarrow 0} \frac{\int_0^x t \sin(10t) dt}{x}$$

is equal to

- (A) $-\frac{1}{5}$
(B) $-\frac{1}{10}$
(C) 0
(D) $\frac{1}{10}$

11. Let

$$\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$$

and

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

be two vectors. If $\vec{c}$ is a vector such that

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

and

$$\vec{c} \cdot \vec{a} = 0$$

, then $\vec{c} \cdot \vec{b}$ is equal to

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

12. Let $f : (1, 3) \rightarrow \mathbb{R}$ be a function defined by

$$f(x) = \frac{x[x]}{1+x^2}$$

, where $[x]$ denotes the greatest integer $\leq x$. Then the range of f is

- (A) $\left(\frac{2}{5}, \frac{1}{2}\right) \cup \left(\frac{3}{4}, \frac{4}{5}\right]$
(B) $\left(\frac{3}{5}, \frac{4}{5}\right)$
(C) $\left(\frac{2}{5}, \frac{4}{5}\right]$
(D) $\left(\frac{2}{5}, \frac{3}{5}\right] \cup \left(\frac{3}{4}, \frac{4}{5}\right)$

13. If

$$I = \int_1^2 \frac{dx}{\sqrt{2x^3 - 9x^2 + 12x + 4}}$$

, then :

- (A) $\frac{1}{16} < I^2 < \frac{1}{9}$
(B) $\frac{1}{8} < I^2 < \frac{1}{4}$
(C) $\frac{1}{9} < I^2 < \frac{1}{8}$
(D) $\frac{1}{6} < I^2 < \frac{1}{2}$

14. The area (in sq. units) of the region $\{(x, y) \in \mathbb{R}^2 : x^2 \leq y \leq 3 - 2x\}$, is :

- (A) $\frac{34}{3}$
(B) $\frac{29}{3}$
(C) $\frac{31}{3}$
(D) $\frac{32}{3}$

15. The mirror image of the point (1, 2, 3) in a plane is

$$\left(-\frac{7}{3}, -\frac{4}{3}, -\frac{1}{3}\right)$$

. Which of the following points lies on this plane ?

- (A) (1, -1, 1) (B) (-1, -1, -1)
(C) (-1, -1, 1) (D) (1, 1, 1)

16. The differential equation of the family of curves, $x^2 = 4b(y + b)$, $b \in \mathbb{R}$, is :

- (A) $x(y')^2 = x - 2yy'$ (B) $x(y')^2 = 2yy' - x$
(C) $xy'' = y'$ (D) $x(y')^2 = x + 2yy'$

17. Which of the following statements is a tautology?

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

18. The length of the perpendicular from the origin, on the normal to the curve,

$x^2 + 2xy - 3y^2 = 0$ at the point (2, 2) is

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

19. If a line, $y = mx + c$ is a tangent to the circle, $(x - 3)^2 + y^2 = 1$ and it is perpendicular to a line L_1 , where L_1 is the tangent to the circle, $x^2 + y^2 = 1$ at the point

$$\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$$

, then :

- (A) $c^2 + 6c + 7 = 0$ (B) $c^2 - 7c + 6 = 0$
(C) $c^2 - 6c + 7 = 0$ (D) $c^2 + 7c + 6 = 0$

20. If a hyperbola passes through the point P(10, 16) and it has vertices at $(\pm 6, 0)$, then the equation of the normal to it at P is :

- (A) $2x + 5y = 100$ (B) $x + 3y = 58$
(C) $x + 2y = 42$ (D) $3x + 4y = 94$

21. Let $f(x)$ be a polynomial of degree 3 such that $f(-1) = 10$, $f(1) = -6$, $f(x)$ has a critical point at $x = -1$ and $f'(x)$ has a critical point at $x = 1$. Then $f(x)$ has a local minima at $x =$ _____.

22. If

$$\frac{\sqrt{2} \sin \alpha}{\sqrt{1 + \cos 2\alpha}} = \frac{1}{7}$$

and

$$\sqrt{\frac{1 - \cos 2\beta}{2}} = \frac{1}{\sqrt{10}}$$

$$\alpha, \beta \in \left(0, \frac{\pi}{2}\right)$$

then $\tan(\alpha + 2\beta)$ is equal to _____.

23. The number of 4 letter words (with or without meaning) that can be formed from the eleven letters of the word 'EXAMINATION' is _____.

24. The sum,

$$\sum_{n=1}^7 \frac{n(n+1)(2n+1)}{4}$$

is equal to _____.

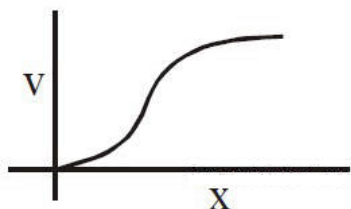
25. Let a line $y = mx$ ($m > 0$) intersect the parabola, $y^2 = x$ at a point P, other than the origin. Let the tangent to it at P meet the x-axis at the point Q. If area $(\Delta OPQ) = 4$ sq. units, then m is equal to _____.

Physics - Section A · Multiple Choice Questions

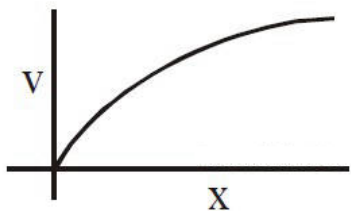
26. Consider a mixture of n moles of helium gas and $2n$ moles of oxygen gas (molecules taken to be rigid) as an ideal gas. Its C_p/C_v value will be :

- (A) 23/15 (B) 67/45
(C) 40/27 (D) 19/13

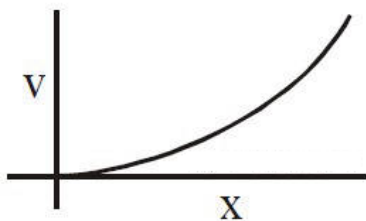
27. A particle of mass m and charge q is released from rest in a uniform electric field. If there is no other force on the particle, the dependence of its speed v on the distance x travelled by it is correctly given by (graphs are schematic and not drawn to scale)



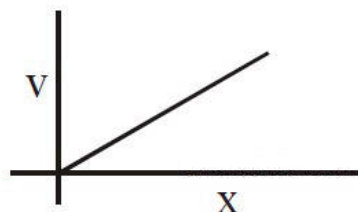
(A)



(B)



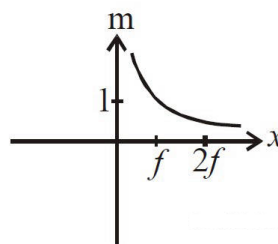
(C)



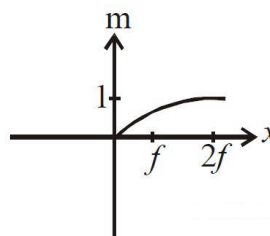
(D)

28. An object is gradually moving away from the focal point of a concave mirror along the axis of the mirror. The graphical representation of the magnitude of linear magnification (m) versus distance of the object from the mirror (x) is correctly given by :

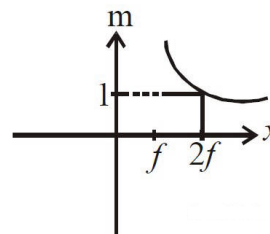
(Graphs are drawn schematically and are not to scale)



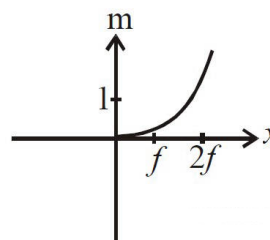
(A)



(B)

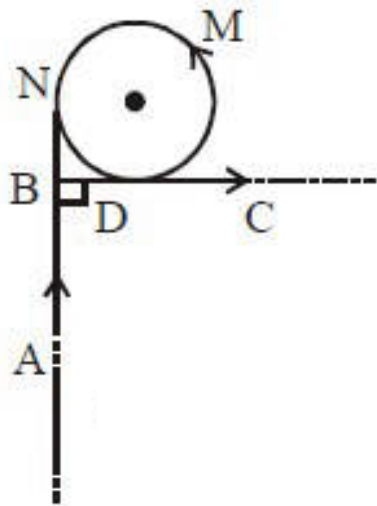


(C)



(D)

29. A very long wire ABDMNDC is shown in figure carrying current I . AB and BC parts are straight, long and at right angle. At D wire forms a circular turn DMND of radius R . AB, BC parts are tangential to circular turn at N and D. Magnetic field at the centre of circle is :



- (A) $\frac{\mu_0 I}{2\pi R} (\pi + 1)$
 (B) $\frac{\mu_0 I}{2\pi R} \left(\pi - \frac{1}{\sqrt{2}} \right)$
 (C) $\frac{\mu_0 I}{2R}$
 (D) $\frac{\mu_0 I}{2\pi R} \left(\pi + \frac{1}{\sqrt{2}} \right)$

30. A transverse wave travels on a taut steel wire with a velocity of v when tension in it is 2.06×10^4 N. When the tension is changed to T , the velocity changed to $v/2$. The value of T is close to :

- (A) 30.5×10^4 N (B) 2.50×10^4 N
 (C) 10.2×10^2 N (D) 5.15×10^3 N

31. A plane electromagnetic wave of frequency 25 GHz is propagating in vacuum along the z -direction. At a particular point in space and time, the magnetic field is given by

$$\vec{B} = 5 \times 10^{-8} \hat{j} T$$

. The corresponding electric field $\vec{E}$ is (speed of light $c = 3 \times 10^8 \text{ ms}^{-1}$)

- (A) $15 \hat{i} \text{ V/m}$ (B) $-15 \hat{i} \text{ V/m}$
 (C) $1.66 \times 10^{-16} \hat{i} \text{ V/m}$ (D) $-1.66 \times 10^{-16} \hat{i} \text{ V/m}$

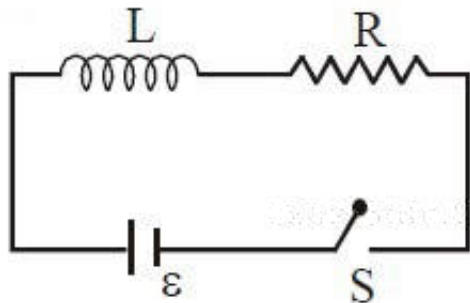
32. A galvanometer having a coil resistance 100Ω gives a full scale deflection when a current of 1 mA is passed through it. What is the value of the resistance which can convert this galvanometer into a voltmeter giving full scale deflection for a potential difference of 10 V?

- (A) $8.9 \text{ k}\Omega$ (B) $10 \text{ k}\Omega$
 (C) $9.9 \text{ k}\Omega$ (D) $7.9 \text{ k}\Omega$

33. Consider two charged metallic spheres S_1 and S_2 of radii R_1 and R_2 , respectively. The electric fields E_1 (on S_1) and E_2 (on S_2) on their surfaces are such that $E_1/E_2 = R_1/R_2$. Then the ratio V_1 (on S_1) / V_2 (on S_2) of the electrostatic potentials on each sphere is :

- (A) $(R_1/R_2)^2$ (B) (R_2/R_1)
 (C) $(R_1/R_2)^3$ (D) R_1/R_2

34. As shown in the figure, a battery of emf ε is connected to an inductor L and resistance R in series. The switch is closed at $t = 0$. The total charge that flows from the battery, between $t = 0$ and $t = t_c$ (t_c is the time constant of the circuit) is :

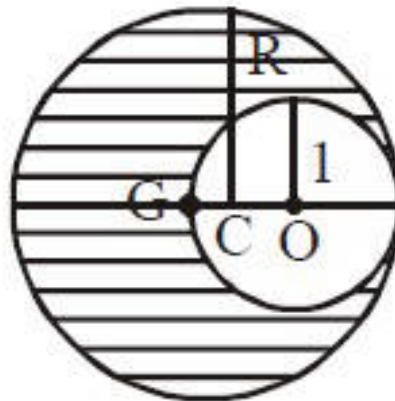


- (A) $\frac{\varepsilon L}{eR^2}$
 (B) $\frac{\varepsilon L}{R^2}$
 (C) $\frac{\varepsilon L}{R^2} \left(1 - \frac{1}{e}\right)$
 (D) $\frac{\varepsilon R}{eL^2}$

35. A particle moves such that its position vector $\vec{r}(t) = \cos \omega t \hat{i} + \sin \omega t \hat{j}$ where ω is a constant and t is time. Then which of the following statements is true for the velocity $\vec{v}(t)$ and acceleration $\vec{a}(t)$ of the particle :

- (A) $\vec{v}$ and $\vec{a}$ both are perpendicular to $\vec{r}$
 (B) $\vec{v}$ and $\vec{a}$ both are parallel to $\vec{r}$
 (C) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed towards the origin
 (D) $\vec{v}$ is perpendicular to $\vec{r}$ and $\vec{a}$ is directed away from the origin

36. As shown in figure, when a spherical cavity (centered at O) of radius 1 is cut out of a uniform sphere of radius R (centered at C), the centre of mass of remaining (shaded) part of sphere is at G , i.e., on the surface of the cavity. R can be determined by the equation :



- (A) $(R^2 + R - 1)(2 - R) = 1$
 (B) $(R^2 - R - 1)(2 - R) = 1$
 (C) $(R^2 - R + 1)(2 - R) = 1$
 (D) $(R^2 + R + 1)(2 - R) = 1$

37. A uniform sphere of mass 500 g rolls without slipping on a plane horizontal surface with its centre moving at a speed of 5.00 cm/s. Its kinetic energy is :

- (A) $8.75 \times 10^{-3} \text{ J}$
 (B) $1.13 \times 10^{-3} \text{ J}$
 (C) $8.75 \times 10^{-4} \text{ J}$
 (D) $6.25 \times 10^{-4} \text{ J}$

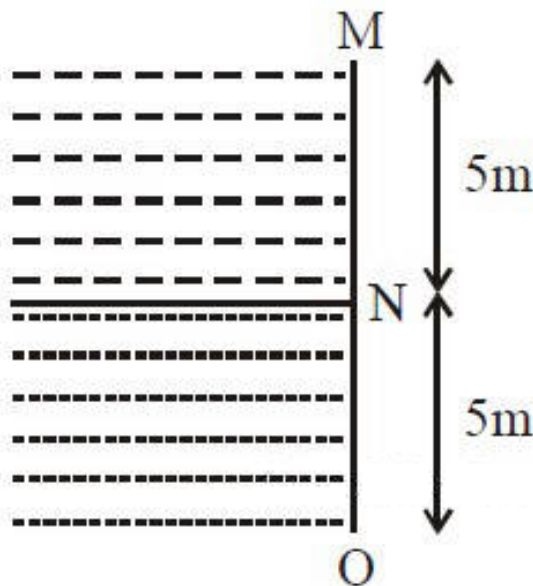
38. A particle of mass m is dropped from a height h above the ground. At the same time another particle of the same mass is thrown vertically upwards from the ground with a speed of $\sqrt{2gh}$. If they collide head-on completely inelastically, the time taken for the combined mass to reach the ground, in units of

$$\sqrt{\frac{h}{g}}$$

is :

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

39. Two liquids of densities ρ_1 and ρ_2 ($\rho_2 = 2\rho_1$) are filled up behind a square wall of side 10 m as shown in figure. Each liquid has a height of 5 m. The ratio of the forces due to these liquids exerted on upper part MN to that at the lower part NO is (Assume that the liquids are not mixing)



- (A) 1/3
 (B) 1/2
 (C) 1/4
 (D) 2/3

40. In a double slit experiment, at a certain point on the screen the path difference between the two interfering waves is $\frac{1}{8}$ th of a wavelength. The ratio of the intensity of light at that point to that at the centre of a bright fringe is :

- (A) 0.853
 (B) 0.568
 (C) 0.672
 (D) 0.760

41. An electron (mass m) with initial velocity

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

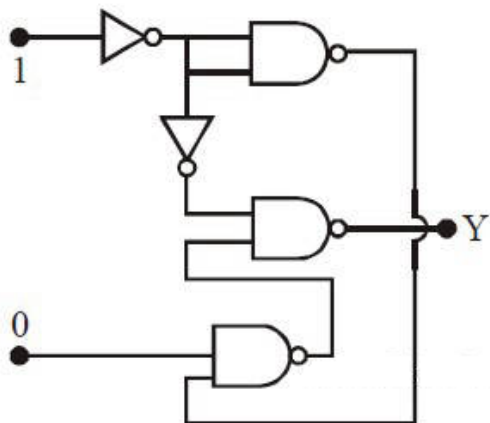
is in an electric field

$$\vec{E} = -E_0 \hat{k}$$

. If λ_0 is initial de-Broglie wavelength of electron, its de-Broglie wave length at time t is given by :

- (A) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$
 (B) $\frac{\lambda_0 \sqrt{2}}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$
 (C) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{2m^2 v_0^2}}}$
 (D) $\frac{\lambda_0}{\sqrt{2 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$

42. In the given circuit, value of Y is :

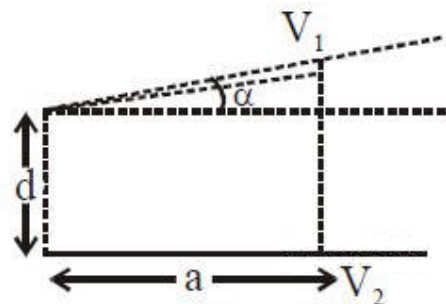


- (A) toggles between 0 and 1
(B) 1
(C) will not execute
(D) 0

43. A simple pendulum is being used to determine the value of gravitational acceleration g at a certain place. The length of the pendulum is 25.0 cm and a stop watch with 1s resolution measures the time taken for 40 oscillations to be 50 s. The accuracy in g is :

- (A) 4.40%
(B) 3.40%
(C) 2.40%
(D) 5.40%

44. A capacitor is made of two square plates each of side 'a' making a very small angle α between them, as shown in figure. The capacitance will be close to :



- (A) $\frac{\epsilon_0 a^2}{d} \left(1 + \frac{\alpha a}{d} \right)$
(B) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{\alpha a}{4d} \right)$
(C) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{\alpha a}{2d} \right)$
(D) $\frac{\epsilon_0 a^2}{d} \left(1 - \frac{3\alpha a}{2d} \right)$

45. A Carnot engine having an efficiency of $\frac{1}{10}$ is being used as a refrigerator. If the work done on the refrigerator is 10 J, the amount of heat absorbed from the reservoir at lower temperature is :

- (A) 90 J
(B) 99 J
(C) 1 J
(D) 100 J

46. The first member of the Balmer series of hydrogen atom has a wavelength of $6561 \text{ \AA}$. The wavelength of the second member of the Balmer series (in nm) is:

47. The series combination of two batteries, both of the same emf 10 V , but different internal resistance of 20Ω and 5Ω , is connected to the parallel combination of two resistors 30Ω and $R \Omega$. The voltage difference across the battery of internal resistance 20Ω is zero, the value of R (in Ω) is :

48. A ball is dropped from the top of a 100 m high tower on a planet. In the last $\frac{1}{2} \text{ s}$ before hitting the ground, it covers a distance of 19 m . Acceleration due to gravity (in ms^{-2}) near the surface on that planet is _____.

49. Three containers C_1 , C_2 and C_3 have water at different temperatures. The table below shows the final temperature T when different amounts of water (given in litres) are taken from each containers and mixed (assume no loss of heat during the process)

C_1	C_2	C_3	T
1l	2l	—	60°C
—	1l	2l	30°C
2l	—	1l	60°C
1l	1l	1l	θ

The value of θ (in $^\circ\text{C}$ to the nearest integer) is

50. An asteroid is moving directly towards the centre of the earth. When at a distance of $10R$ (R is the radius of the earth) from the earth's centre, it has a speed of 12 km/s . Neglecting the effect of earth's atmosphere, what will be the speed of the asteroid when it hits the surface of the earth (escape velocity from the earth is 11.2 km/s) ? Give your answer to the nearest integer in kilometer/s _____.

51. Arrange the following bonds according to their average bond energies in descending order : C-Cl, C-Br, C-F, C-I

- (A) C-Br > C-I > C-Cl > C-F
(B) C-Cl > C-Br > C-I > C-F
(C) C-I > C-Br > C-Cl > C-F
(D) C-F > C-Cl > C-Br > C-I

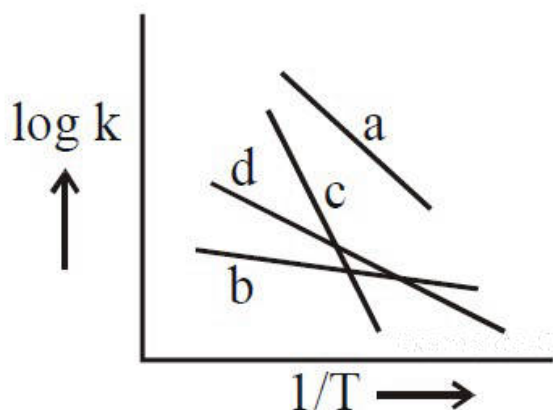
52. The radius of the second Bohr orbit, in terms of the Bohr radius, a_0 , in Li^{2+} is :

- (A) $\frac{2a_0}{9}$
(B) $\frac{2a_0}{3}$
(C) $\frac{4a_0}{9}$
(D) $\frac{4a_0}{3}$

53. Consider the following plots of rate constant versus

$$\frac{1}{T}$$

for four different reactions. Which of the following orders is correct for the activation energies of these reactions?



- (A) $E_c > E_a > E_d > E_b$ (B) $E_a > E_c > E_d > E_b$
(C) $E_b > E_a > E_d > E_c$ (D) $E_b > E_d > E_c > E_a$

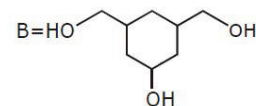
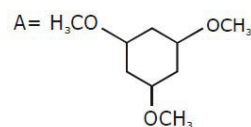
54. Hydrogen has three isotopes (A), (B) and (C). If the number of neutron(s) in (A), (B) and (C) respectively, are (x), (y) and (z), the sum of (x), (y) and (z) is :

- (A) 3 (B) 1
(C) 4 (D) 2

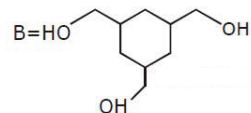
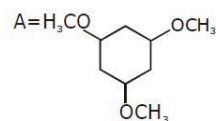
55. The increasing order of the atomic radii of the following elements is :-

- (a) C (b) O
(c) F (d) Cl
(e) Br
(A) (a) < (b) < (c) < (d) < (e) (B) (c) < (b) < (a) < (d) < (e)
(C) (b) < (c) < (d) < (a) < (e) (D) (d) < (c) < (b) < (a) < (e)

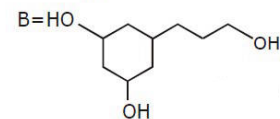
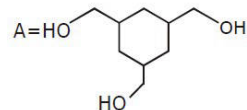
56. Among the compounds A and B with molecular formula $\text{C}_9\text{H}_{18}\text{O}_3$, A is having higher boiling point than B. The possible structures of A and B are :



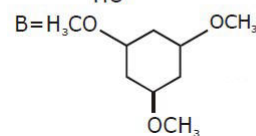
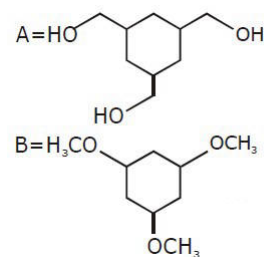
(A)



(B)



(C)



(D)

57. Two monomers in maltose are :

- (A) α -D-glucose and α -D-galactose (B) α -D-glucose and α -D-fructose
(C) α -D-glucose and α -D-glucose (D) α -D-glucose and β -D-glucose

58. For the following Assertion and Reason, the correct option is :

Assertion : The pH of water increases with increase in temperature.

Reason : The dissociation of water into H^+ and OH^- is an exothermic reaction.

- (A) Both assertion and reason are false. (B) Both assertion and reason are true, but the reason is not the correct explanation for the assertion.
(C) Both assertion and reason are true, and the reason is the correct explanation for the assertion. (D) Assertion is not true, but reason is true.

59. The correct order of the calculated spin-only magnetic moments of complexes (A) to (D) is:

- (A) $Ni(CO)_4$
(B) $[Ni(H_2O)_6]Cl_2$
(C) $Na_2[Ni(CN)_4]$
(D) $PdCl_2(PPh_3)_2$

- (A) (C) < (D) < (B) < (A) (B) (C) $\approx$ (D) < (B) < (A)
(C) (A) $\approx$ (C) $\approx$ (D) < (B) (D) (A) $\approx$ (C) < (B) $\approx$ (D)

60. Kjeldahl's method cannot be used to estimate nitrogen for which of the following compounds?

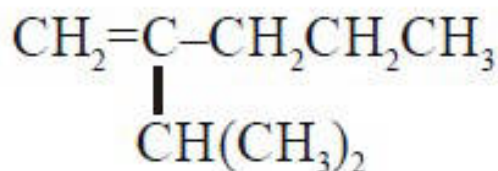
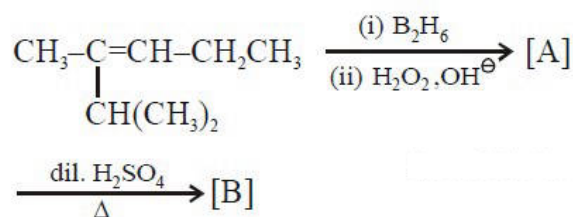
- (A) $C_6H_5NH_2$



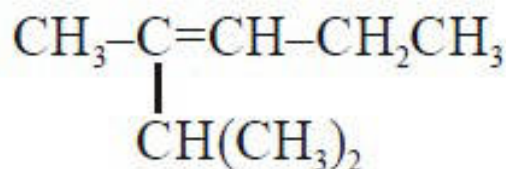
- (C) $C_6H_5NO_2$

- (D) $CH_3CH_2-C \equiv N$

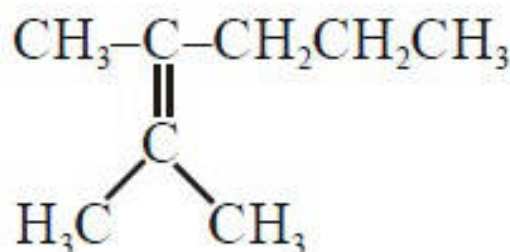
61. The major product [B] in the following sequence of reactions is :-



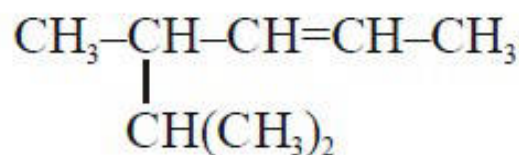
(A)



(B)

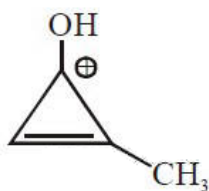
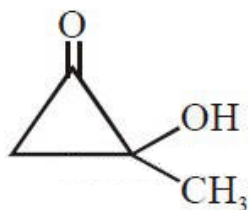
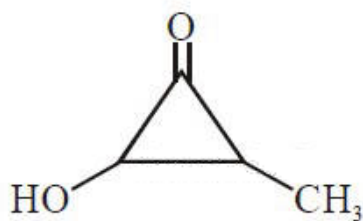
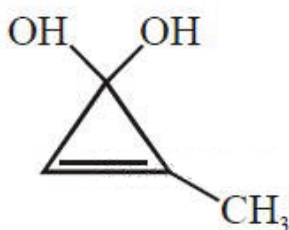
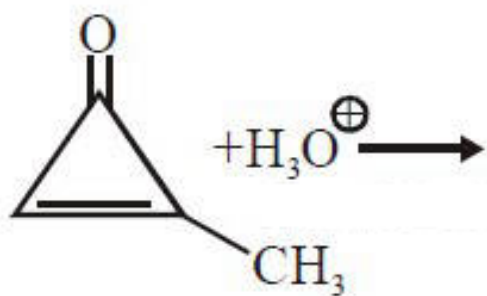


(C)



(D)

62. The major product in the following reaction is:



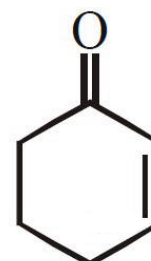
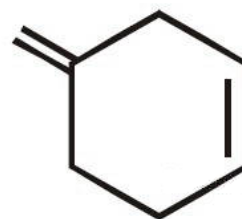
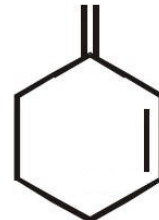
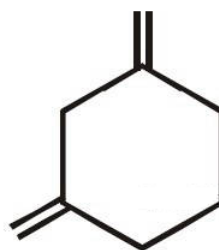
63. A metal (A) on heating in nitrogen gas gives compound B. B on treatment with H_2O gives a colourless gas which when passed through CuSO_4 solution gives a dark blue-violet coloured solution. A and B respectively, are :

- (A) Na and NaNO_3 (B) Na and Na_3N
 (C) Mg and Mg_3N_2 (D) Mg and $\text{Mg}(\text{NO}_3)_2$

64. An unsaturated hydrocarbon X absorbs two hydrogen molecules on catalytic hydrogenation and also gives following reaction :



B(3 - oxo - hexanedicarboxylic acid) X will be :-



65. Among (a) – (d) the complexes that can display geometrical isomerism are :

- (a) $[\text{Pt}(\text{NH}_3)_3\text{Cl}]^+$
(b) $[\text{Pt}(\text{NH}_3)\text{Cl}_5]^-$
(c) $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NO}_2)]$
(d) $[\text{Pt}(\text{NH}_3)_4\text{ClBr}]^{2+}$

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

66. For the following Assertion and Reason, the correct option is

Assertion : For hydrogenation reactions, the catalytic activity increases from Group 5 to Group 11 metals with maximum activity shown by Group 7-9 elements.

Reason : The reactants are most strongly adsorbed on group 7-9 elements.

- (A) Both assertion and reason are true and the reason is the correct explanation for the assertion. (B) The assertion is true, but the reason is false.
(C) Both assertion and reason are true but the reason is not the correct explanation for the assertion. (D) Both assertion and reason are false.

67. White Phosphorus on reaction with concentrated NaOH solution in an inert atmosphere of CO_2 gives phosphine and compound (X). (X) on acidification with HCl gives compound (Y). The basicity of compound (Y) is :

- (A) 2 (B) 4
(C) 1 (D) 3

68. Preparation of Bakelite proceeds via reactions.

- (A) Electrophilic substitution and dehydration (B) Condensation and elimination
(C) Nucleophilic addition and dehydration (D) Electrophilic addition and dehydration

69. Which of the following compounds is likely to show both Frenkel and Schottky defects in its crystalline form?

- (A) CsCl (B) AgBr
(C) ZnS (D) KBr

70. Among the reactions (a) - (d), the reaction(s) that does/do not occur in the blast furnace during the extraction of iron is/are :

- (a) $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$
(b) $3\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2\text{Fe}_3\text{O}_4 + \text{CO}_2$
(c) $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$
(d) $\text{FeO} \rightarrow \text{Fe} + \frac{1}{2}\text{O}_2$

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

Chemistry - Section B · Numerical Value Questions

71. For an electrochemical cell

$\text{Sn(s)} \mid \text{Sn}^{2+}(\text{aq}, 1\text{M}) \parallel \text{Pb}^{2+}(\text{aq}, 1\text{M}) \mid \text{Pb(s)}$
the ratio

$$\frac{[\text{Sn}^{2+}]}{[\text{Pb}^{2+}]}$$

when this cell attains equilibrium is _____.

(Given

$$E_{\text{Sn}^{2+}|\text{Sn}}^0 = -0.14\text{V}$$

,

$$E_{\text{Pb}^{2+}|\text{Pb}}^0 = -0.13\text{V}$$

,

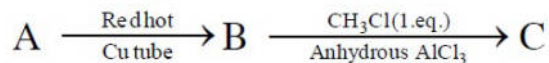
$$\frac{2.303RT}{F} = 0.06$$

)

72. Complexes (ML_5) of metals Ni and Fe have ideal square pyramidal and trigonal bipyramidal geometries, respectively. The sum of the 90° , 120° and 180° L-M-L angles in the two complexes is _____.

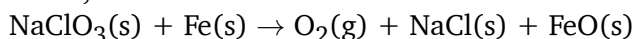
73. At constant volume, 4 mol of an ideal gas when heated from 300 K to 500K changes its internal energy by 5000 J. The molar heat capacity at constant volume is _____.

74. In the following sequence of reactions the maximum number of atoms present in molecule 'C' in one plane is _____.



(A is a lowest molecular weight alkyne)

75. NaClO_3 is used, even in spacecrafts, to produce O_2 . The daily consumption of pure O_2 by a person is 492L at 1 atm, 300K. How much amount of NaClO_3 , in grams, is required to produce O_2 for the daily consumption of a person at 1 atm, 300 K?



$$R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

- End of Question Paper -