



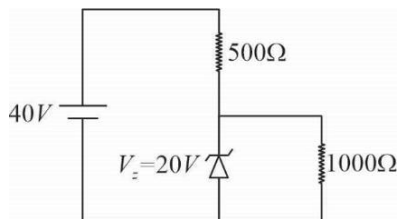








24. A wooden wheel having radius of  $1m$  is to be fitted with an iron ring around it. The diameter of the ring is  $6mm$  smaller than the wooden wheel. If the coefficient of linear expansion of iron is  $1.2 \times 10^{-5} / ^\circ C$ , then find the minimum increase in temperature (in  $^\circ C$ ) to fit the ring on the wheel.
25. A capacitor of capacitance  $3\mu F$  is charged to a potential difference of  $12V$ . Another identical capacitor, initially uncharged is filled with a dielectric having dielectric constant  $K$  and it is connected to the charged capacitor. The final common potential difference across both capacitors is found to be  $2V$ . Find the value of  $k$ .
26. Speed of sound in a resonance tube experiment is given by the expression  $v = 2f_0(l_2 - l_1)$  where  $f_0$  is the frequency of the tuning fork and  $l_1, l_2$  are length of the air column. Consider  $f_0 = 300Hz$  with no error in its value. Lengths of the air column  $l_1$  and  $l_2$  are measured as  $25.0cm$  and  $80.0cm$  respectively. Find the absolute error in the speed of sound (in m/s).
27. An inductor of inductance  $0.1H$  and a resistor of resistance  $8\Omega$  are connected in series to a battery of emf  $1.5V$  through a switch. Find the initial rate of growth of current when the switch is closed (in A/s).
28. A particle of mass  $3kg$  moving with speed of  $3m/s$  is acted upon by an impulse. As a result, the particle starts moving in a direction  $90^\circ$  to the original direction with a speed of  $4m/s$ . Find the impulse acted upon on the particle in SI units.
29. In the given circuit find the current through the Zener diode in  $mA$ .



30. A beam of unpolarized light of intensity  $I_0$  is incident on a polaroid  $A$ . Then it is passed through another polaroid  $B$ . If the intensity of the emergent light is  $18\%$  of the original unpolarized light then find the angle (nearest integer in degree) between the principal plane of polaroid  $A$  and  $B$ .

## SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

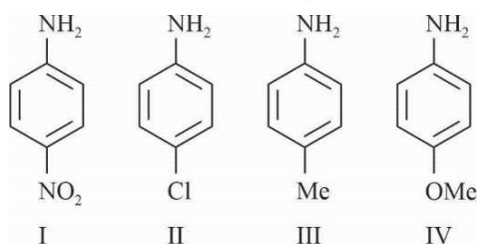
1. The BOD value of two samples of water are 4ppm and 18 ppm, respectively and this indicates:

- (A) Clean water, Clean Water (B) Polluted water, Clean water  
(C) Clean water, Polluted water (D) Polluted water, Polluted water

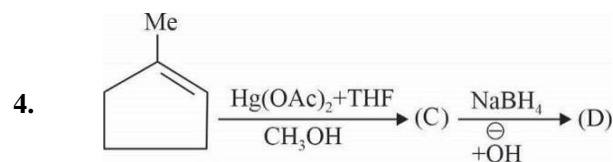
2. Molality of sulphuric acid solution in which the mole fraction of water is 0.74 is:

- (A) 9.51 (B) 12 (C) 19.5 (D) 5.25

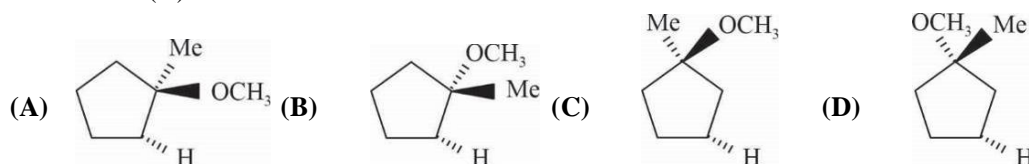
3. The increasing order of  $pK_b$  values of the following compounds is:



- (A) II < I < III < IV (B) II < III < I < IV  
(C) IV < III < II < I (D) IV < II < III < I



Structure of (D) is:



5. Arrange the following solutions in the decreasing order of pH:

- (1) 0.1 NaOH (2) 0.1 M NaCl  
(3) 0.1 M H<sub>2</sub>SO<sub>4</sub> (4) 0.1 M NH<sub>4</sub>Cl  
(A) (1) > (2) > (3) > (4) (B) (1) > (4) > (3) > (2)  
(C) (1) > (4) > (2) > (3) (D) (1) > (2) > (4) > (3)

6. Among the nitrates of alkaline earth metals, the thermal stability of Mg(NO<sub>3</sub>)<sub>2</sub> and Sr(NO<sub>3</sub>)<sub>2</sub> respectively are:

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

7. For the reaction  $\text{NH}_4\text{Cl}(\text{g}) \rightleftharpoons \text{NH}_3(\text{g}) + \text{HCl}(\text{g})$

- (A)  $K_c = K_p(\text{RT})^{-2}$  (B)  $K_p = K_c(\text{RT})^2$   
(C)  $K_c = K_p(\text{RT})^{-1}$  (D)  $K_c = K_p(\text{RT})$

8. The incorrect statement is:
- (A)  $\text{H}_2\text{SO}_5$  contain no S – S bond      (B) Marshall's acid contain one S – S bond.  
 (C)  $\text{H}_2\text{S}_2\text{O}_7$  contain no S – S bond      (D)  $\text{H}_2\text{S}_2\text{O}_4$  contain one S – S bond.

9. Consider the assertion and reason given below:  
 Assertion (A) : Buta-1,3 - diene is a monomer of gutta percha.  
 Reason (R) : Gutta Percha is formed through cationic addition polymerisation  
 Choose the correct answer from the following:
- (A) (A) and (R) both are wrong  
 (B) Both (A) and (R) are correct and (R) is correct explanation of (A)  
 (C) (A) is wrong but (R) is correct  
 (D) Both (A) and (R) are correct but (R) is not correct explanation of (A)

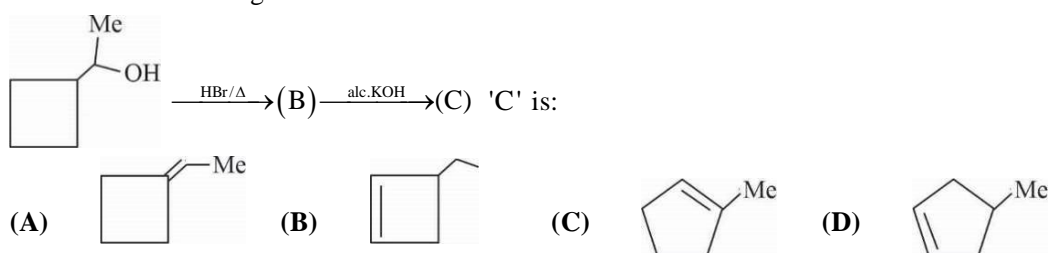
10. Which of the following compounds do not show geometrical isomerism?
- (A) But -2-ene      (B) 3-Methyl -2- butenoic acid  
 (C) 3-Methyl-2-pentenoic acid      (D) 3-Phenyl-2- propenoic acid

11. The equilibrium constant for the reaction given below at 400K, if  $\Delta H^\circ = 77.2 \text{ KJ/mol}$  and  $\Delta S^\circ = 122 \text{ JK}^{-1} \text{ mol}^{-1}$ ,  $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$
- (A)  $1.95 \times 10^{-6}$       (B)  $1.2 \times 10^{-12}$       (C)  $5.0 \times 10^{-6}$       (D)  $1.95 \times 10^{-4}$

12. Which of the following is not an example of  $\sigma$  - bonded organometallic complex?
- (A)  $\text{Pb}(\text{C}_2\text{H}_5)_4$       (B)  $\text{Zn}(\text{C}_2\text{H}_5)_2$       (C) Ferrocene      (D)  $(\text{C}_2\text{H}_5)_2\text{CuLi}$

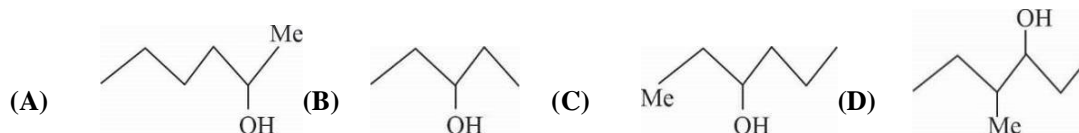
13. The set that contains atomic numbers of only inner transition elements is:
- (A) 9,17,34,38      (B) 21,25,42,72      (C) 32,53,64,67      (D) 98,67,103,90

14. Consider the following reactions



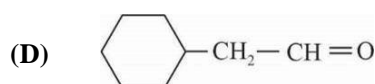
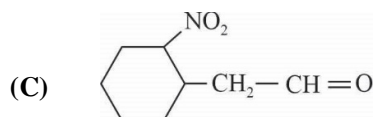
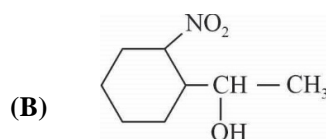
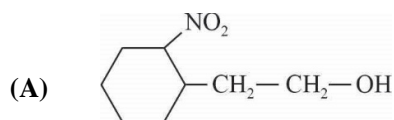
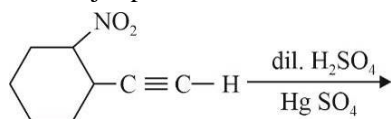
15.  $\text{CH}_3-\text{CH}=\text{CH}_2 \xrightarrow[\text{H}_2\text{O}_2/\text{OH}^-]{\text{B}_2\text{H}_6/\text{THF}} (\text{B}) \xrightarrow{\text{HCl}} (\text{C})$   
 (i) Mg in Dry ether  
 (ii)  $\text{Me}-\text{CH}_2-\text{CH}=\text{O}$   
 (iii)  $\text{H}_3\text{O}^+$

Compound D is:





16. The major product obtained from the following reaction is:



17. The Lanthanoid that does not show +2 oxidation states is:

- (A) Sm                      (B) Gd                      (C) Tm                      (D) Nd

18. The correct statement is:

- (A) Magnalium is an alloy of Al and Cu  
(B) Bell metal is an alloy of Cu and Sn  
(C) Gun metal is an alloy of Cu, Zn and Ni  
(D) Chrome steel is an alloy of Cr, Al and Ni

19. The incorrect statement for lyophilic colloids is

- (A) Easy to prepare  
(B) Viscosity is high and surface tension is low for D.P. (dispersed phase) than D.M. (dispersion medium)  
(C) Viscosity and surface tension for D.P. is almost similar to D.M.  
(D) Stable

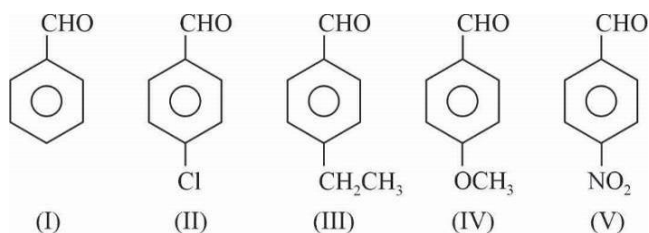
20. For a reaction  $\text{P} \rightarrow \text{Q}$ , the  $E_a$  for the forward reaction and backward reaction is  $15\text{KJ/mol}$  and  $5\text{KJ/mol}$ , respectively, potential energy of P is  $8\text{KJ/mol}$ , then the heat of reaction (in kJ) is:

- (A) 10                      (B) 15                      (C) 20                      (D) 23

## SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. The answer to each question is a NUMERICAL VALUE. For each question, enter the correct numerical value of the answer. If the answer is a decimal numerical value, then round-off the value to TWO decimal places. If the answer is an Integer value, then do not add zero in the decimal places. *In the OMR, do not bubble the ⊕ sign for positive values. However, for negative values, ⊖ sign should be bubbled.* (Example: 6, 81, 1.50, 3.25, 0.08)

21. In an estimation of sulphur by carius method, 0.25gm of an organic compound gave 0.35gm of  $\text{BaSO}_4$ . The mass percentage of sulphur in the compound is \_\_\_\_\_. (Molecular weight of  $\text{BaSO}_4 = 233 \text{ g/mol}$ )
22. How much propyl alcohol must be added to 1.00 lt. of water so the solution will not freeze at  $-15^\circ\text{C}$ ? ( $K_f$  of water =  $1.86 \text{ K Kg mol}^{-1}$ ) [ $d(\text{H}_2\text{O}) = 1 \text{ g/ml}$  and molecular mass of propyl alcohol =  $60 \text{ g/mol}$ ]
23. Calculate the volume occupied by 12.0g of propane gas at  $60^\circ\text{C}$  and 740mm of pressure. (Molecular weight of C =  $12 \text{ g/mol}$ , H =  $1 \text{ g/mol}$ ) [ $R = 0.082 \text{ L atm/mol K}$ ]
24. 200 ml of 0.5M solution of  $\text{CuBr}_2$  was electrolysed using Pt as electrodes with a current of 0.965 ampere in one hour, what is the normality of the remaining  $\text{CuBr}_2$  solution assuming no change in volume?
25. The number of  $\text{Cl}=\text{O}$  bond in Chlorous acid is\_\_\_\_\_.
26. For how many metals leaching method is used for its concentration of ore  
Metals: Cu, Zn, Pb, Al, Au, Ag
27. The EAN value of  $[\text{Ti}(\sigma\text{-C}_5\text{H}_5)_2(\pi\text{-C}_5\text{H}_5)_2]$  is\_\_\_\_\_.
28. The Number of Species which have square pyramidal shape  
Species:-  $\text{XeOF}_4, \text{ClF}_5, \text{XeF}_4, \text{PCl}_5, \text{XeO}_3\text{F}_2, \text{SbCl}_5, \text{BrF}_5$ .
29. Consider the following reaction  
 $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2 + \text{HBr} \xrightarrow{40^\circ\text{C}}$  the number of geometrically active products is/are:
30. The number of compounds which do not show Fehling solution test?  
Compounds:



## SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

- If  $\Delta = \begin{vmatrix} 1 & 3\cos\theta & 1 \\ \sin\theta & 1 & 3\cos\theta \\ 1 & \sin\theta & 1 \end{vmatrix}$ , then the maximum value of  $\Delta$  is:

(A) 3                      (B) 9                      (C) 10                      (D) 13
- The statement  $p \rightarrow (q \rightarrow p)$  is equivalent is:

(A)  $p \rightarrow (q \wedge p)$     (B)  $p \rightarrow (q \vee p)$     (C)  $p \rightarrow (p \rightarrow q)$     (D)  $p \rightarrow (q \leftrightarrow p)$
- From first 100 natural numbers, 3 numbers are selected. If these numbers are in A.P., then the probability that these numbers are even is:

(A)  $\frac{29}{66}$                       (B)  $\frac{1}{66}$                       (C)  $\frac{12}{49}$                       (D)  $\frac{29}{49}$
- The parabola  $y = x^2 - 9$  and  $y = kx^2$  intersect each other at the points  $A$  and  $B$ . If the length  $AB$  is equal to 10 units then the value of  $k$  is:

(A)  $\frac{9}{16}$                       (B)  $\frac{9}{25}$                       (C)  $\frac{16}{25}$                       (D)  $\frac{16}{9}$
- Let  $\alpha$  and  $\beta$  are roots of the equation  $x^2 - 6x + 12 = 0$ . The value of the expression  $(\alpha - 2)^{12} + \frac{(\beta - 6)^{12}}{\alpha^{12}} - 1$  is:

(A)  $2^{10}$                       (B)  $3^{10}$                       (C)  $2^{12}$                       (D)  $3^{12}$
- $a, b, c$  are positive integers forming an increasing G.P. whose common ratio is a natural number.  $b - a$  is cube of a natural number and  $\log_6 a + \log_6 b + \log_6 c = 6$ , then  $a + b + c =$

(A) 100                      (B) 111                      (C) 122                      (D) 189
- The value of 'a' for which the straight line  $4x - 3y + 4z - 2 = 0 = 3x - 2y + z - 5$  is parallel to the plane  $2x - y + az - 7 = 0$ , is:

(A) 2                      (B) -2                      (C) 8                      (D) -8
- Set of all possible values of  $k$  for which  $f(x) = \sin x - \cos x - kx + b$  decreases for all real values of  $x$ , is:

(A)  $(-\infty, 1)$                       (B)  $[-\sqrt{2}, \infty)$                       (C)  $[\sqrt{2}, \infty)$                       (D)  $[-\infty, \sqrt{2}]$
- The tangent at a point where eccentric angle  $60^\circ$  on the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 (a > b)$  meet the auxiliary circle at  $L$  and  $M$ . If  $LM$  subtends a right angle at the centre, then eccentricity of the ellipse is:

(A)  $\frac{1}{\sqrt{7}}$                       (B)  $\frac{2}{\sqrt{7}}$                       (C)  $\frac{3}{\sqrt{7}}$                       (D)  $\frac{1}{2}$

10. Coefficient of variation of two distributions are 50% and 60% and their arithmetic means are 30 and 25 respectively. Difference of standard deviation is:  
 (A) 1 (B) 1.5 (C) 2.5 (D) 0
11. The remainder when  $5^{2222}$  is divided by 7 is:  
 (A) 2 (B) 3 (C) 4 (D) 5
12. A variable line passing through the point  $P\left(2, \frac{3}{2}\right)$  meets co-ordinate axes at points A and B, then locus of the foot of perpendicular from origin on the line is:  
 (A)  $x^2 + y^2 - 4x - 3y = 0$  (B)  $x^2 + y^2 - 3x + 4y = 0$   
 (C)  $2x^2 + 2y^2 - 4x - 3y = 0$  (D)  $2x^2 + 2y^2 + 4x + 3y = 0$
13. Two teachers are taking 6 students to a zoo. The teachers decide to split up. Each student must choose one of the teachers, with the condition that each teacher must take at least one student. Number of possible ways of doing this is:  
 (A) 60 (B) 62 (C) 56 (D) 64
14. If  $\frac{dy}{dx} = (e^y - x)^{-1}$  where  $y(0) = 0$ , then  $y$  is equal to:  
 (A)  $\frac{1}{2} \ln(1+x^2)$  (B)  $\ln(1+x^2)$  (C)  $\ln(x + \sqrt{1+x^2})$  (D)  $\ln(x + \sqrt{1-x^2})$
15. Area of the region bounded by  $x = 0, y = 0, x = 2, y = 2, y \leq e^x$  and  $y \geq \ln x$ , is:  
 (A)  $6 - 4 \ln 2$  (B)  $4 \ln 2 - 2$  (C)  $2 \ln 2 - 4$  (D)  $6 - 2 \ln 2$
16. Let  $\alpha, \beta$  and  $\gamma$  are the real roots of equation  $x^3 + ax^2 + bx + c = 0 (a, b, c \in R, a \neq 0)$ . If system of equations  $\alpha x + \beta y + \gamma z = 0, \beta x + \gamma y + \alpha z = 0, \gamma x + \alpha y + \beta z = 0$  has non trivial solution then the value of  $\frac{a^2}{b}$  is:  
 (A) 1 (B) 2 (C) 3 (D) 4
17. If  $I_1 = \int_0^1 (1-x^4)^7 dx$  and  $I_2 = \int_0^1 (1-x^4)^6 dx$  then  $\frac{29 I_1}{4 I_2}$  is equal to:  
 (A) 3 (B) 5 (C) 7 (D) 9
18. If  $z = \cos 20^\circ + i \sin 20^\circ$ , then  $|z + 2z^2 + 3z^3 + \dots + 18z^{18}|^{-1}$  is:  
 (A)  $\frac{2}{9} \sin 10^\circ$  (B)  $\frac{1}{9} \sin 10^\circ$  (C)  $\frac{2}{9} \sin 20^\circ$  (D)  $\frac{1}{9} \sin 20^\circ$
19.  $\lim_{x \rightarrow \infty} \frac{\int_0^x \tan^{-1} t dt}{\sqrt{x^2 + 1}}$  is equal to:  
 (A)  $\frac{\pi}{2}$  (B) 0 (C) 1 (D)  $\pi$
20. Let  $a^2, b^2, c^2$  be three distinct numbers in A.P. If  $ab + bc + ca = 1$  then  $(b+c), (c+a)$  and  $(a+b)$  are in:  
 (A) A.P. (B) G.P. (C) H.P. (D) None of these

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21. Let  $a, b, c$  be the roots of the equation  $x^3 - 9x^2 + 15x + 2 = 0$ . The volume of a parallelepiped with non-parallel sides  $a\hat{i} + b\hat{j} + c\hat{k}, b\hat{i} + c\hat{j} + a\hat{k}$  and  $c\hat{i} + a\hat{j} + b\hat{k}$  is \_\_\_\_\_.
22. There are two sets  $A = \{a : a \in N \text{ and } -3 \leq a \leq 5\}$  and  $B = \{b : b \in Z \text{ and } 0 \leq b \leq 4\}$ . The number of elements common in  $A \times B$  and  $B \times A$  are \_\_\_\_\_.
23. If  $x$  &  $y$  are real numbers satisfying the relation  $x^2 + y^2 - 6x + 8y + 24 = 0$  then minimum value of  $\log_2(x^2 + y^2)$  is \_\_\_\_\_.
24. Let  $f(x) = \begin{cases} \left( \sin \frac{2x^2}{a} + \cos \frac{3x}{b} \right)^{\frac{ab}{x^2}}, & x \neq 0 \\ e^{2x+3}, & x = 0 \end{cases}$  is a continuous function at  $x = 0, \forall b \in R$ , then  $\left| \frac{1}{a_{\min}} \right|$  is \_\_\_\_\_.
25. A vertical pole  $PS$  has two marks at  $Q$  and  $R$  such that portions  $PQ, PR$  and  $PS$  subtends angle  $\alpha, \beta, \gamma$  respectively at a point on the ground which is at distance  $x$  from the bottom of pole  $P$ . If  $PQ = 1, PR = 2, PS = 3$  and  $\alpha + \beta + \gamma = 180^\circ$ , then  $x^2$  is \_\_\_\_\_.
26. The product of real roots of the equation  $|x|^{6/5} - 26|x|^{3/5} - 27 = 0$  is  $-3^k$  where  $k$  is \_\_\_\_\_.
27. In a hurdle race, a runner has probability  $p$  of jumping over a specific hurdle. Given that in 5 trials, the runner succeeded 3 times, the conditional probability that the runner has succeeded in the first trial is \_\_\_\_\_.
28. If  $\tan x + \tan\left(x + \frac{\pi}{3}\right) + \tan\left(x + \frac{2\pi}{3}\right) = 3$  then value of  $\tan 3x$  is \_\_\_\_\_.
29. Let  $n(A) = 4$  and  $n(B) = 6$ , then the number of one- one functions from  $A$  to  $B$  is \_\_\_\_\_.
30. Let  $\int \frac{x^{1/2}}{\sqrt{1-x^3}} dx = \frac{2}{3} g(f(x)) + c$  and  $f(x) = x^{3/2}$ , then the value of  $g(0)$  is \_\_\_\_\_.

  End of Mock JEE Main - 5 | JEE 2021   