

SAMPLE TEST PAPER

Do not open this Test Booklet until you are asked to do so.

Read carefully the Instructions on this Test Booklet.

Paper : Physics, Chemistry &
Mathematics

Important Instructions :

1. Immediately fill in the form number on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The candidates should not write their Form Number anywhere else (except in the specified space) on the Test Booklet/Answer Sheet.
3. The test is of **3 hours** duration.
4. The Test Booklet consists of **90** questions. The maximum marks are **300**.
5. There are **three** parts in the question paper 1, 2, 3 consisting of **Physics, Chemistry and Mathematics** having **30 questions** in each subject and each subject having **Two sections**.
 - (i) Section-I contains **20 multiple choice** questions with **only one correct** option.
Marking scheme : +4 for correct answer and 0 if not Attempted and -1 in all other cases.
 - (ii) Section-II contains **10 Numerical Value Type** questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking.
Marking scheme : +4 for correct answer and 0 in all other cases..
6. Use **Blue/Black Ball Point Pen only** for writing particulars/markings responses on **Side-1** and **Side-2** of the Answer Sheet. **Use of pencil is strictly prohibited**.
7. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone any electronic device etc, except the Identity Card inside the examination hall/room.
8. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
9. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator on duty in the Room/Hall. **However, the candidate are allowed to take away this Test Booklet with them.**
10. If you want to attempt any question then circle should be properly darkened as shown below, otherwise leave blank.

Correct Method



Wrong Method



11. Do not fold or make any stray marks on the Answer Sheet.

Name of the Candidate (in Capitals) _____

Form Number : in figures _____

: in words _____

Centre of Examination (in Capitals) : _____

Candidate's Signature : _____ Invigilator's Signature : _____

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SECTION-I : (Maximum Marks : 80)

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
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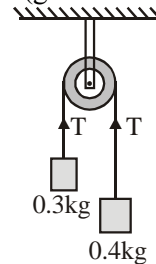
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Zero Marks : 0 If none of the bubbles is darkened.

Negative Marks : -1 In all other cases

1. The percentage error in measurement of mass and speed are 3% and 2% then error in kinetic energy will be :-
 (A) 6% (B) 7%
 (C) 10% (D) 12%
2. The two vectors $\vec{A} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{B} = 7\hat{i} - 5\hat{j} - 3\hat{k}$ are :-
 (A) Parallel
 (B) Perpendicular
 (C) Antiparallel
 (D) None of the above
3. A motor cyclist travels a certain distance with a uniform speed of 30 m/s and immediately turns back and returns to starting point with a uniform speed 20 m/s. Then the average speed of the motor cycle is :-
 (A) 12 m/s (B) 50 m/s (C) 24 m/s (D) 25 m/s

4. Two bodies of mass 0.3 kg and 0.4 kg are tied to the ends of a weightless string which passes over a smooth pulley as shown in the figure. The tension in the string is :- ($g = 9.8 \text{ m/s}^2$)



- (A) 3.06 N (B) 3.36 N (C) 4.05 N (D) 3.0 N
5. A particle starts from extreme position and executes S.H.M. with amplitude 10 cm and time period $\pi/2$ second then equation for its motion is :-
 (A) $x = 10 \sin 4t$ (B) $x = 10 \cos 4t$
 (C) $x = 10 \sin 2t$ (D) $x = 10 \cos 2t$
 6. Six particles each of mass m are placed at the corners of a regular hexagon of side length a . If point mass m_0 is placed at the centre of the hexagon. Then the gravitational force on the point mass m_0 is :
 (A) $\frac{6Gm^2}{a^2}$ (B) $\frac{6Gmm_0}{a^2}$
 (C) Zero (D) None
 7. Which one of the following statements is true:-
 (A) Both light and sound waves in air are transverse
 (B) The sound waves in air are longitudinal while the light waves are transverse
 (C) Both light and sound waves in air are longitudinal
 (D) Both light and sound waves can travel in vacuum
 8. If S is stress and Y is Young's modulus of material of a wire, the energy stored in the wire per unit volume is :-
 (A) $2S^2Y$ (B) $\frac{S^2}{2Y}$ (C) $\frac{2Y}{S^2}$ (D) $\frac{S}{2Y}$

19. Two walls of thicknesses d_1 and d_2 and thermal conductivity K_1 and K_2 are in contact. In the steady state, if the temperatures at the outer surface are T_1 and T_2 , the temperature at the common wall is :-

- (A) $\frac{K_1 T_1 d_2 + K_2 T_2 d_1}{K_1 d_2 + K_2 d_1}$ (B) $\frac{K_1 T_1 + K_2 T_2}{d_1 + d_2}$
 (C) $\left[\frac{K_1 d_1 + K_2 d_2}{T_1 + T_2} \right] T_1 T_2$ (D) $\frac{K_1 d_1 T_1 + K_2 d_2 T_2}{K_1 d_1 + K_2 d_2}$

20. If two metallic plates of equal thicknesses and thermal conductivities K_1 and K_2 are put together face to face and a common plate is constructed, then the equivalent thermal conductivity of this plate will be :-

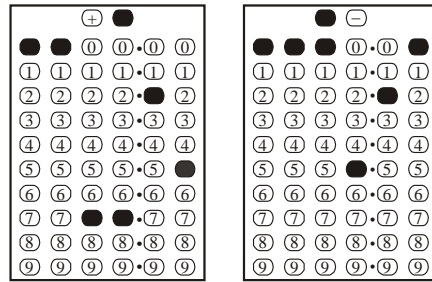


- (A) $\frac{K_1 K_2}{K_1 + K_2}$ (B) $\frac{2K_1 K_2}{K_1 + K_2}$
 (C) $\frac{[K_1^2 K_2^2]^{3/2}}{K_1 K_2}$ (D) $\frac{[K_1^2 + K_2^2]^{3/2}}{2K_1 K_2}$

SECTION-II : (Maximum Marks: 20)

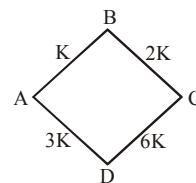
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- The answer to each question is a **NUMERICAL VALUE**.
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For Example : If answer is $-77.25, 5.2$ then fill the bubbles as follows.

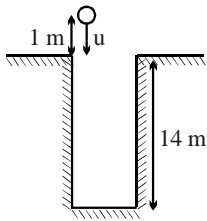


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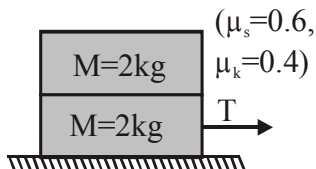
1. The angular velocity of a body is $\vec{\omega} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and a torque $\vec{\tau} = \hat{i} + 2\hat{j} + 3\hat{k}$ acts on it. The rotational power (in watt) will be :-
2. A particle is released from rest at origin. It moves under influence of potential field $U = x^2 - 3x$, kinetic energy (in J) at $x = 2$ is:-
3. Heat required (in Kcal) to convert 5kg ice at 0°C into water at 100°C is -
4. Four rods of equal length and area of cross section and thermal conductivities $K, 2K, 3K$ and $6K$ are joined as shown. If temperature difference between A and C is 100°C then temperature difference (in $^\circ\text{C}$) between B and D will be.



5. A diatomic ideal gas is compressed adiabatically to $1/32$ of its initial volume. If the initial temperature of the gas is T_i (in Kelvin) and the final temperature is αT_i , the value of α is
6. A boy throws a ball with speed u in a well of depth 14 m as shown. On bounce with bottom of the well the speed of the ball gets halved. What should be the minimum value of u (in m/s) such that the ball may be able to reach his hand again? It is given that his hands are at 1 m height from top of the well while throwing and catching.

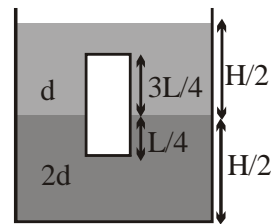


7. The coefficient of static and kinetic friction between the two blocks and also between the lower block and the ground are $\mu_s = 0.6$ and $\mu_k = 0.4$. Find the value of tension T applied on the lower block at which the upper block begins to slip relative to lower block.



8. An object of mass 0.2 kg executes SHM along the x -axis with frequency of $(25/\pi)$ Hz. At the point $x = 0.04$ m the object has KE 0.5 J and PE 0.4 J. The amplitude of oscillation is _____.

9. The potential energy of a 2 kg particle moving along the x axis is given by $U(x) = (4.0\text{J/m}^2)x^2 + (1.0\text{J/m}^4)x^4$. When the particle is at $x = 1.0\text{m}$, find its acceleration. [only conservative forces are acting]
10. A container of a large uniform cross-sectional area A resting on a horizontal surface holds two immiscible, non-viscous and incompressible liquids of densities d and $2d$ each of height $\frac{H}{2}$ as shown. The lower density liquid is open to atmosphere. A homogeneous solid cylinder of length $L \left(< \frac{H}{2} \right)$, cross-sectional area $\frac{A}{5}$ is immersed such that it floats with its axis vertical to the liquid-liquid interface with length $\frac{L}{4}$ in denser liquid. The density of the solid cylinder is nd then the value of n is :-



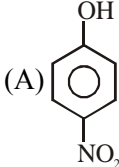
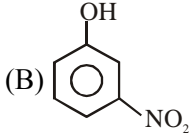
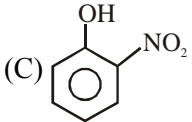
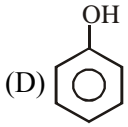
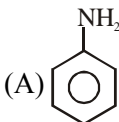
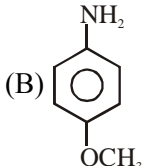
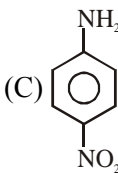
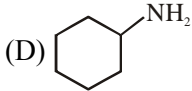
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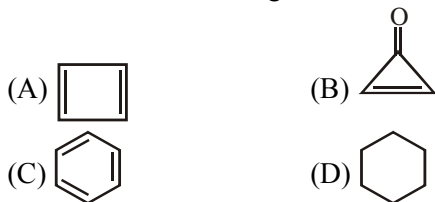
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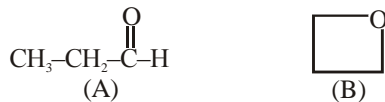
Negative Marks : -1 In all other cases

- K_{sp} of $\text{Ca}(\text{OH})_2$ is 4.0×10^{-6} . At what minimum pH, Ca^{2+} ions start precipitating in 0.01 M CaCl_2 ?
 (A) $12 - \log 2$ (B) $12 + \log 2$
 (C) $2 - \log 2$ (D) $2 + \log 2$
- In which of the following cases pH is greater than 7?
 (A) 50ml of 0.1 M HCl + 50 ml of 0.1 M NaCl
 (B) 50ml of 0.1 M H_2SO_4 + 50 ml of 0.2 M NaOH
 (C) 50ml of 0.1M CH_3COOH + 50ml of 0.1M KOH
 (D) 50ml of 0.1 M HNO_3 + 50 ml of 0.1 M NH_3
- On increasing the temperature of pure water
 (A) Both pH and pOH increase
 (B) Both pH and pOH decrease
 (C) pH increases and pOH decreases
 (D) pH decreases and pOH increases
- Which one of the following reductions involves oxidation reduction?
 (A) $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$
 (B) $\text{HBr} + \text{AgNO}_3 \rightarrow \text{AgBr} + \text{HNO}_3$
 (C) $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
 (D) $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$
- The van der Waals' equation for 0.5 mol gas is:-
 (A) $\left(P + \frac{a}{4V^2}\right)\left(\frac{V-b}{2}\right) = \frac{2RT}{2}$
 (B) $\left(P + \frac{a}{4V^2}\right)(2V-b) = RT$
 (C) $\left(P + \frac{a}{4V^2}\right)(2V-4b) = RT$
 (D) $\left(P + \frac{a}{4V^2}\right) = \frac{2RT}{2(V-b)}$
- In the reaction, $\text{A}_2(\text{g}) + 4\text{B}_2(\text{g}) \rightleftharpoons 2\text{AB}_4(\text{g})$, $\Delta H < 0$ the formation of AB_4 is will be favoured at :
 (A) Low temperature, high pressure
 (B) High temperature, low pressure
 (C) Low temperature, low pressure
 (D) High temperature, high pressure
- The heat of neutralisation of a strong acid and a strong alkali is 57.0 KJ/mol. The heat released when 0.5 mole of HNO_3 solution is mixed with 0.2 mole of KOH is :
 (A) -11.4 KJ (B) 11.4 KJ
 (C) 28.5 KJ (D) 34.9 KJ
- Which of the following more acidic compound :-
 (A)  (B) 
 (C)  (D) 
- Which of the following more basic compound :-
 (A)  (B) 
 (C)  (D) 

10. Which of the following least stable :-

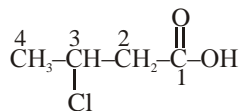


11. Isomerism between (A) and (B) :-

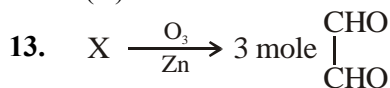


- (A) Ring-chain-isomerism
 (B) Position isomerism
 (C) Chain isomerism
 (D) Not isomerism

12. Write the IUPAC name of the compound :-



- (A) 3-chloro butenoic acid
 (B) 3-chloro propanoic acid
 (C) 2-chloro-butenoic acid
 (D) 4-chloro butenoic acid



X is :

- (A) Aromatic (B) Anti-aromatic
 (C) Non-aromatic (D) Non Cyclic

14. Maximum change in %s character of bonding orbital of central atom occurs in which of the following transformation.

- (A) $\text{BF}_3 + \text{F}^- \longrightarrow \text{BF}_4^-$
 (B) $\text{NH}_3 + \text{H}^+ \longrightarrow \text{NH}_4^+$
 (C) $\text{N}_2\text{O}_5 \longrightarrow \text{NO}_2^+ \cdot \text{NO}_3^-$
 (D) $\text{BeF}_2 \longrightarrow [\text{BeF}_4]^{2-}$

15. In which of the following pairs of molecules are non existing

- (A) SF_4, PF_5 (B) OF_4, OF_6
 (C) SF_4, SF_6 (D) $\text{OF}_2, \text{O}_2\text{F}_2$

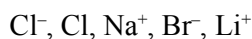
16. Aqueous solution of borax is:

- (A) acidic towards litmus
 (B) basic towards litmus
 (C) neutral towards litmus
 (D) weakly acidic and no change on litmus

17. Which of the following contains dangling bond.

- (A) Rhombic sulphur
 (B) White phosphorus
 (C) Benzene
 (D) Graphite

18. Select the correct order of size for :-



- (A) $\text{Br}^- > \text{Cl} > \text{Cl}^- > \text{Na}^+ > \text{Li}^+$
 (B) $\text{Cl}^- > \text{Br}^- > \text{Cl} > \text{Na}^+ > \text{Li}^+$
 (C) $\text{Br}^- > \text{Na}^+ > \text{Cl}^- > \text{Cl} > \text{Li}^+$
 (D) $\text{Br}^- > \text{Cl}^- > \text{Cl} > \text{Na}^+ > \text{Li}^+$

19. The correct order of stability of $\text{Al}^+, \text{Al}^{+2}, \text{Al}^{+3}$:-

- (A) $\text{Al}^{+3} > \text{Al}^{+2} > \text{Al}^+$ (B) $\text{Al}^{+2} > \text{Al}^{+3} > \text{Al}^+$
 (C) $\text{Al}^+ < \text{Al}^{+2} < \text{Al}^{+3}$ (D) $\text{Al}^{+3} > \text{Al}^+ > \text{Al}^{+2}$

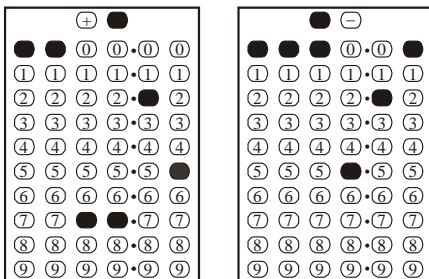
20. Which will have the maximum value of electron affinity $\text{O}^x, \text{O}^y, \text{O}^z$ (x,y,z, are having values 0,-1,-2):-

- (A) O^x (B) O^y
 (C) O^z (D) All are equal

SECTION-II : (Maximum Marks: 20)

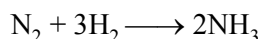
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1. In the following reaction, if 56 g of N_2 react with H_2 . What will be volume of NH_3 at STP.



2. Suppose that, when a spring was wound, 100 J of work was done on it but 15 J escaped to the surrounding as heat. The change in I.E. of the spring is :-

3. Calculate the total number of stereo isomerism in given compound.



4. How many electrons can for into $n = 3, \ell = 2,$

$$m = -1, s = +\frac{1}{2} \text{ :-}$$

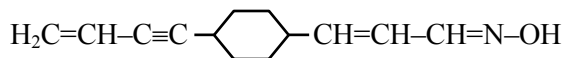
5. How many elements are possible for 1st period of the periodic table if quantum number has values from 0, 1, 2(n + 1) :-

6. $A + B \rightarrow C + D$

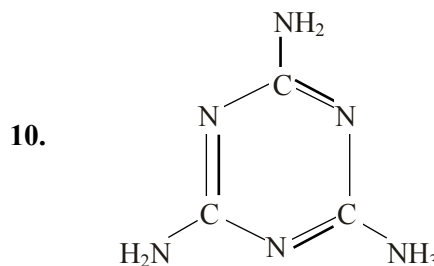
Initially the concentration of A & B both are equal but at the equilibrium, concentration of D will be twice of that of A, then what will be the equilibrium constant of the reaction ?

7. The oxidation state of chromium in the final product formed by the reaction between KI & acidified potassium dichromate solution is :-

8. Total number of geometrical isomer are possible for the given compound :-



9. If the ionisation potential of an atom is 20 V. Its first excitation potential will be :-



Find the number of σ bond in melamine

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1. The value of expression $1 - \frac{\sin^2 y}{1 + \cos y} + \frac{1 + \cos y}{\sin y} - \frac{\sin y}{1 - \cos y}$ is equal to :-
 (A) 0 (B) 1
 (C) $\sin y$ (D) $\cos y$
2. The numerical value of $\tan \frac{\pi}{3} + 2 \tan \frac{2\pi}{3} + 4 \tan \frac{4\pi}{3} + 8 \tan \frac{8\pi}{3}$ is equal to :-
 (A) $-5\sqrt{3}$ (B) $-\frac{5}{\sqrt{3}}$
 (C) $5\sqrt{3}$ (D) $\frac{5}{\sqrt{3}}$
3. If $P \rightarrow (q \vee r)$ is false then the true value of p, q, r respectively are :-
 (A) F, T, T (B) T, T, F
 (C) T, F, F (D) F, F, F
4. One of the general solutions of the equation $4 \sin\theta \sin 2\theta \sin 4\theta = \sin 3\theta$ is :-
 (A) $(3n \pm 1)\frac{\pi}{12} \forall n \in I$ (B) $(4n \pm 1)\frac{\pi}{9} \forall n \in I$
 (C) $(3n \pm 1)\frac{\pi}{9} \forall n \in I$ (D) $(3n \pm 1)\frac{\pi}{3} \forall n \in I$

5. In ΔABC , $a = 8$, $b = 10$ and $C = 12$, Then C is equal to :-
 (A) $\frac{A}{2}$ (B) $2A$
 (C) $3A$ (D) None
6. If $ax^2 + bx + c = 0$ & $bx^2 + cx + a = 0$ have a common root & a, b, c are non zero real number then $\frac{a^3 + b^3 + c^3}{abc} =$
 (A) 0 (B) 3
 (C) -1 (D) -3
7. The first term of an A.P of consecutive odd integers is $p^2 + 1$. The sum of $(2p + 1)$ terms of this series can be expressed as
 (A) $(p + 1)^2$ (B) $(p + 1)^3$
 (C) $(2p + 1)(p + 1)^2$ (D) $p^3(p + 1)^3$
8. The coefficient of x^8 in the expansion of $(1 - x^4)^4 (1 + x)^5$ is :-
 (A) 20 (B) -32
 (C) -14 (D) 30
9. How many words can be formed from the letter of the word "SULTAN" if one vowel at odd place and one vowel at even place :-
 (A) 432 (B) 216
 (C) 60 (D) None
10. 3 coins are tossed together then probability at least one shows Head is :-
 (A) $\frac{1}{8}$ (B) $\frac{7}{8}$
 (C) $\frac{1}{2}$ (D) None
11. Modulus of $\frac{1}{1+i}$ is :-
 (A) 2 (B) $\frac{1}{2}$
 (C) $\frac{1}{\sqrt{2}}$ (D) None

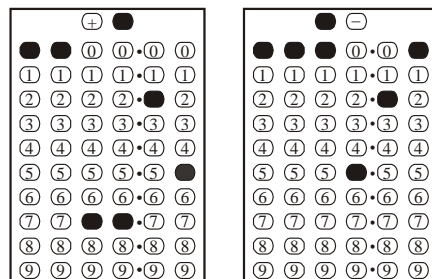
12. The domain of the function, $f(x) = \log_{0.2} \log_{0.5} \log_{0.25} x$ is –
- (A) $(1, \infty)$ (B) $\left(\frac{1}{4}, \infty\right)$
 (C) $\left(\frac{1}{4}, 1\right)$ (D) \mathbb{R}
13. $\lim_{x \rightarrow 0} \frac{3^x - 1}{\sqrt{x+1} - 1}$ is equal to –
- (A) $\log_e 9$ (B) $\log_e 3$
 (C) 0 (D) 1
14. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $2x \frac{dy}{dx} + y$ equals :-
- (A) \sqrt{x} (B) $2\sqrt{x}$
 (C) $\frac{1}{2}\sqrt{x}$ (D) x
15. Line segment joining the points $(2, -3)$ and $(-5, 6)$ is divided by the line $x + y + z = 0$ in ratio :-
- (A) 2 : 3 (B) 3 : 2
 (C) 1 : 3 (D) 3 : 1
16. The sides of a triangle are $x + y - 5 = 0$, $x - y + 1 = 0$ and $y - 1 = 0$ then the distance between its orthocentre and circum centre is :-
- (A) 1 (B) 2
 (C) $\sqrt{2}$ (D) None
17. If the lines $x + q = 0$, $y - 2 = 0$ and $3x + 2y + 5 = 0$ are concurrent then the value of q is :-
- (A) 1 (B) 2
 (C) 3 (D) None
18. Circles $x^2 + y^2 - 4x + 6y + 8 = 0$ and $x^2 + y^2 - 10x - 6y + 14 = 0$ touches each other at a point which is :-
- (A) $(3, 1)$ (B) $(1, 3)$
 (C) $(-1, 3)$ (D) $(3, -1)$

19. If the vertex of parabola is $(2, 3)$ and directrix is $3x + 4y + 7 = 0$ then the length of its latus rectum is :-
- (A) 5 (B) 10 (C) 20 (D) None
20. The eccentricity of an ellipse $4x^2 + y^2 - 8x + 2y + 1 = 0$ is :-
- (A) $\frac{1}{\sqrt{3}}$ (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{\sqrt{3}}{2}$ (D) None

SECTION-II : (Maximum Marks: 20)

- This section contains **TEN** Questions. Attempt any five Questions. First five Questions Attempt will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, -0.33 , -0.30 , 30.27, -127.30 , if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darkening the corresponding bubbles in the ORS.

For Example : If answer is -77.25 , 5.2 then fill the bubbles as follows.



- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4 If **ONLY** the correct numerical value is entered as answer.
Zero Marks : 0 In all other cases.

1. If $(1-\tan\theta)(1+\tan\theta)\sec^2\theta + 2^{\tan^2\theta} = 0$ then the number of value of θ in the interval $(-\pi/2, \pi/2)$ is
2. Mean deviation of the distribution 11, 6, 2, 5, 1, 14, 10 was found to be minimum about a number λ then value of λ will be :-
3. The fifth & 8th term of GP are 7! and 8! respectively. If the sum of n terms is 2205 then n =
4. Find x so that the point (6, 5, -3) is at a distance of 13 units from the point (x, -7, 0) :-
5. If the equation of a hyperbola whose axes are of equal length and eccentricity is $\sqrt{2}$, and distance between focii is 16, is $x^2 - y^2 = k$ then the value of k is :-
6. If $\sin(\alpha + \beta) = 1$ and $\sin(\alpha - \beta) = \frac{1}{2}$ then $\tan(\alpha + 2\beta) \tan(2\alpha + \beta)$ is equal to :-
7. If solution of equation $3\cos^2\theta - 2\sqrt{3}\sin\theta\cos\theta - 3\sin^2\theta = 0$ are $n\pi + \frac{\pi}{r}$ and $n\pi + \frac{\pi}{s}$ then $|r - s|$ is equal to :-
8. The number of words can be formed from all the letter of the word 'MONDAY' in which first letters is a vowel are :-
9. $\lim_{x \rightarrow 2} \frac{x^2 - x - 2}{x^2 - 2x - \sin(x - 2)}$ equals :-
10. The distance from the centre of the circle $x^2 + y^2 - 2x = 0$ to the straight line passing through the points of intersection of the two circles $x^2 + y^2 + 5x - 8y + 1 = 0$, $x^2 + y^2 - 3x + 7y - 25 = 0$ is :-