MATHEMATICS

1. $1+3+6+ \dots\dots + \frac{n(n+1)}{2} =$
   A. $\frac{n(n+1)(2n+1)}{6}$
   B. $\frac{n^2(n+1)^2}{4}$
   C. $\frac{n(n+1)(2n+1)}{4}$
   D. $\frac{n(n+1)(n+2)}{6}$
2. If A = {Rhombuses}, B={Rectangles}, then $A \cap B$ =
   A. {Squares}
   B. {Rectangles}
   C. {Rhombuses}
   D. {Parallelograms}
3. If α , β are the roots of $ax^2 + bx + c = 0$ then $(a\alpha + b)^{-3} + (a\beta + b)^{-3} =$
   A. $a^3 - 2abc$
   B. $b^3 - 3abc$
   C. $\frac{c^3 - 3abc}{b^3 c^3}$
   D. $\frac{b^3 - 3abc}{a^3 c^3}$
4. The term independent of x in $\left(ax + \frac{b}{x}\right)^{14}$ is
   A. 14!a7b7
   B. $\frac{14!}{(7!)^2} a^7 b^7$
   C. $\frac{14!}{7!} a^7 b^7$
   D. $\frac{14!}{(17!)^3} a^7 b^7$

Note: All questions are of objective type (multiple choice questions). Each question has four options of which one is correct. Each correct answer will be awarded 2 marks. The wrong answer and unanswered questions will receive nil marks.

5. If $\frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ are in A.P then
    - A. a^2, b^2, c^2 are in A.P
    - B. b^2, c^2, a^2 are in A.P
    - C. b^2, a^2, c^2 are in A.P
    - D. a^2, b^2, c^2 are in G.P
6. If ${}^{(2n+1)}P_{n-1} : {}^{(2n-1)}P_n = 3:5$ then n=
    - A. 4
    - B. 5
    - C. 6
    - D. 3
7. If A=$\begin{bmatrix} 1 & 3 & 0 \\ -1 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$ and B=$\begin{bmatrix} 2 & 3 & 4 \\ 1 & 2 & 3 \\ -1 & 1 & 2 \end{bmatrix}$, then AB=
    - A. $\begin{bmatrix} 5 & 3 & 11 \\ 1 & 2 & 2 \\ 1 & 3 & 5 \end{bmatrix}$
    - B. $\begin{bmatrix} [illegible] & [illegible] & [illegible] \\ -1 & 2 & 4 \\ -2 & 2 & 4 \end{bmatrix}$
    - C. $\begin{bmatrix} 5 & 8 & 11 \\ 1 & 2 & 3 \\ 2 & 2 & -3 \end{bmatrix}$
    - D. $\begin{bmatrix} 5 & 8 & 11 \\ 1 & 2 & 2 \\ 2 & 2 & -3 \end{bmatrix}$
8. The points $\bar{i} + \bar{j} + \bar{k}$, $\bar{i} + 2\bar{j}$, $2\bar{i} + 2\bar{j} + \bar{k}$ and $2\bar{i} + 3\bar{j} + 2\bar{k}$ are
    - A. Collinear
    - B. Coplanar but not collinear
    - C. Non-Coplanar
    - D. Cannot say

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9. The fourth vertex of the square, whose consecutive vertices are (4, 5, 1), (2, 4, -1) and (3, 6, -3), is
    A. (-4, 2, 4)
    B. (4,- 2, -4)
    C. (5, 7, -1)
    D. (5, 0, 1)

10. If $Tan 20^0 = \lambda$, then $\frac{Tan\, 250^0 + Tan\, 340^0}{Tan\, 200^0 - Tan\, 110^0} =$
    A. $\frac{1+\lambda^2}{1-\lambda^2}$
    B. $\frac{1-\lambda^2}{1+\lambda^2}$
    C. $\frac{1+\lambda^2}{2\lambda}$
    D. $\frac{1-\lambda^2}{2\lambda}$

11. In Δ ABC, if $\angle$A, $\angle$B and $\angle$C are in A.P., then $\frac{a+c}{\sqrt{a^2-ac+c^2}} =$
    A. Cos $\left(\frac{A-C}{2}\right)$
    B. Sin $\left(\frac{A-C}{2}\right)$
    C. 2 Cos $\left(\frac{A-C}{2}\right)$
    D. 2 Sin $\left(\frac{A-C}{2}\right)$

12. $\underset{x\to\infty}{\mathrm{Lt}} \frac{\sqrt{1+25x^2}+\sqrt{9x^2-1}}{\sqrt{1+25x^2}-\sqrt{9x^2-1}} =$
    A. 1
    B. 2
    C. 3
    D. 4

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13. The side of a cube is decreased at the rate of 0.04 cm/sec. The rate of decrease in the volume of the cube when the side is 10cm is
    A. 2 cubic cm/sec
    B. 10 cubic cm/sec
    C. 3cubic cm/sec
    D. 16 cubic cm/sec

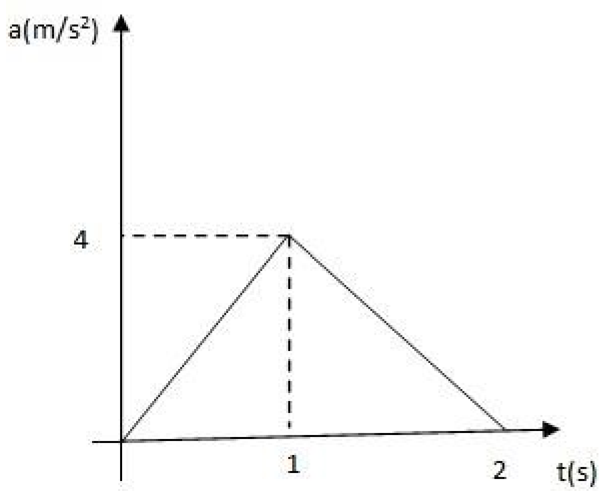
14. $\int \frac{x^{49} Tan^{-1}(x^{50})}{1+x^{100}}\, dx = k(Tan^{-1}(x^{50}))^2 + c$, then $k =$
    A. 1/50
    B. -1/50
    C. 1/100
    D. -1/100

15. If $n \neq 1, \int_0^{\pi/4} (Tan^n x + Tan^{n-2} x)\; d(x-[x]) =$
    A. $\frac{2}{n+1}$
    B. $\frac{1}{n+1}$
    C. $\frac{2}{n-1}$
    D. $\frac{1}{n-1}$

Note: All questions are of objective type (multiple choice questions). Each question has four options of which one is correct. Each correct answer will be awarded 2 marks. The wrong answer and unanswered questions will receive nil marks.

PHYSICS

1. A vector $\bar{A}$ of magnitude two units lies in XY plane. It is inclined at 30^0 with a positive X-axis and at 60^0 with a positive Y-axis. Another vector of magnitude $\bar{B}$ 5 units lies along the positive x-axis. is equal to $\bar{A}.\bar{B}$
   A. $5\sqrt{3}$
   B. $3\sqrt{5}$
   C. $2\sqrt{3}$
   D. $3\sqrt{2}$
2. A bus is moving with a velocity of $10ms^{-1}$ on a straight road. A scooterist wishes to overtake the bus in the 100s. If the bus is at a distance of 1 km from the scooterist, what velocity should the scooterist chase the bus?
   A. $50ms^{-1}$
   B. $40ms^{-1}$
   C. $30ms^{-1}$
   D. $20ms^{-1}$
3. The acceleration - time graph of a particle moving in a straight line is shown in the figure. The velocity of the particle at time t=0 is 2m/s. The velocity after 2s will be

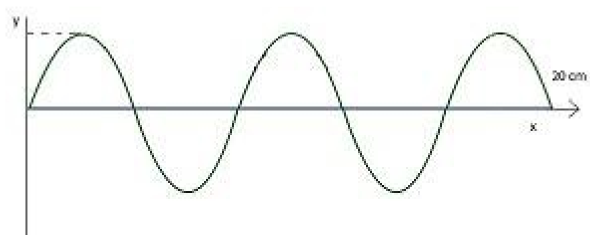


   A. 6 m/s
   B. 4 m/s
   C. 2 m/s
   D. 8 m/s

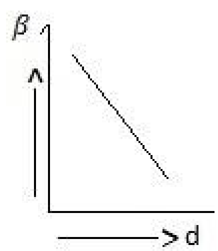
Note: All questions are of objective type (multiple choice questions). Each question has four options of which one is correct. Each correct answer will be awarded 2 marks. The wrong answer and unanswered questions will receive nil marks.

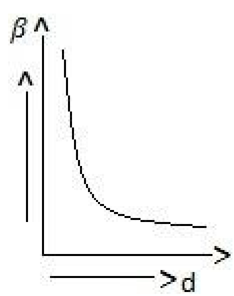
4. A particle is projected vertically upwards from point A on the ground. It takes time t_1 to reach point B, but it continues to move up. If it carries further t_2 time to reach the ground from point B. Then the height of the point B from the ground is
   A. $\frac{1}{2}g(t_1+t_2)^2$
   B. gt_1t_2
   C. $\frac{1}{8}g(t_1+t_2)^2$
   D. $\frac{1}{2}gt_1t_2$
5. A lead ball strikes a wall and falls down. A tennis ball has the same mass, and velocity strikes the same wall and bounces back. Which of the following is correct?
   A. The tennis ball suffers a greater change in momentum
   B. The lead ball suffers a greater change in momentum
   C. Both balls suffer the same change in momentum
   D. The momentum of the lead ball is greater than that of the tennis ball
6. Consider the following statements and identify the correct answer
   (A) The moment of inertia of a rigid body about an axis of rotation is numerically equal to twice the kinetic energy of rotation of the body, when rotating with angular velocity about that axis
   (B) Radius of gyration of a body changes with change in location of the axis of rotation
   A. A is false, but B is true
   B. Both A and B are true
   C. A is true, but B is false
   D. Both A and B are false
7. A tensile force of 2 x 10^5 dyne doubles the length of an elastic cord whose cross section area is 2 cm^2. Young's modulus of the material of the cord is
   A. 2 x 105 N/m2
   B. 2 x 105 dyne/cm2
   C. 1010 dyne/cm2
   D. 104 N/m2

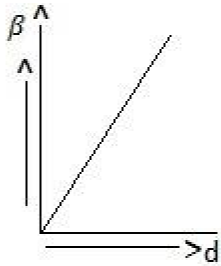
8. Starting with the same initial conditions, an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1 if the process is purely isothermal, W_2 if purely isobaric and W_3 if purely adiabatic, then
    A. $W_1>W_2>W_3$
    B. W2>W3>W1
    C. W2>W1>W3
    D. W1>W3>W2
9. For the wave shown in the fig, the frequency and wavelength if its speed is 320 m/sec are

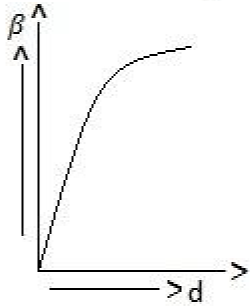


    A. 8 cm, 400Hz
    B. 80 cm, 40Hz
    C. 8 cm, 4000Hz
    D. 40 cm, 8000Hz
10. The correct between fringe width β and distance between the slits (d) is

A. 

B. 

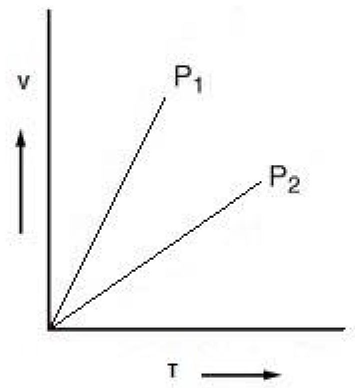
C. 

D. 

CHEMISTRY

1. The number of spectral lines possible when an electron falls from the fifth orbit to ground state in a hydrogen atom is
   A. 4
   B. 15
   C. 10
   D. 21
2. The octet rule is not valid for molecules
   A. CO_2
   B. H_2O
   C. O_2
   D. CO
3. BCl_3 is a planar molecule, whereas NCl_3 is pyramidal because
   A. BCl3 has no lone pair of electrons, but NCl3 has a lone pair of electrons
   B. B-Cl bond is more polar than N-Cl bond
   C. Nitrogen atom is smaller than boron atom
   D. N-Cl bond is more covalent than B-Cl bond
4. I_1 and I_2 of Mg are 178 and 348 Kcal/mole, respectively. The energy required for the reaction $Mg_{(g)} \rightarrow Mg_{(g)}{}^{+2} + 2e$ is
   A. +170 Kcal
   B. +526 Kcal
   C. -170 Kcal
   D. -525 Kcal
5. In the redox reaction,
   $KMnO_4 + 3H_2SO_4 + 5H_2C_2O_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 10CO_2$
   The volume of 0.1M $KMnO_4$ required to oxidize 25ml of 0.25M $H_2C_2O_4$ solution is
   A. 25litre
   B. 125ml
   C. 25ml
   D. 1.25litre

6. V vs T curves at constant pressure P_1 and P_2 for an ideal gas is shown below



Which is correct

A. P1 > P2

B. P1 < P 2

C. P1 = P2

D. All of the above

7. If R is the radius of the spheres in the close-packed arrangement and r is the radius of the octahedral void, then

A. R=0.414r

B. r=0.414R

C. R=0.225r

D. r=0.224R

8. In the reaction $4NH_3+5O_2 \rightarrow 4NO+6H_2O$, the rate of formation of NO is 1x10-3mole/litre-sec. The rate of disappearance of O_2 is

A. 4 X 10-3

B. 5 X 10-3

C. 1.25 X 10-3

D. 0.8 X 10-3

9. Duralumin is an alloy of

A. Al and Mg

B. Al, Mg and Ni

C. Al, Mg, Mn and Cu

D. Al and Ni

10. Copper on reaction with dil HNO_3 give

   A. $Cu(NO_3)_2+N_2O$
   B. $Cu(NO_3)_2+NO$
   C. $Cu(NO_3)_2+NO_2$
   D. $CuNO_3+NO$