

RB IIT Academy SR MAINSTEST 3

1) A salt 'X' on heating liberate one coloured gas and another colourless gas. Both the gases are paramagnetic. The salt 'X' may be

- A) $NaNO_3$ B) KNO_3 C) Na_2CO_3 D) $LiNO_3$

2) In the castner-kellner process, the gases that are liberated in the middle and outer compartments are

- A) H_2 & Cl_2 B) Cl_2 & H_2 C) Cl_2 & O_2 D) O_2 & Cl_2

3) The solubilities of carbonates decrease down the magnesium group. This is due to a decrease in

- A) Hydration energies of cations B) inter-ionic attraction C) entropy of solution formation
D) Lattice energies of solids

4) A certain compound (X) gives a brick red flame test. When KI solution is added to a solution of (X) in presence of acetic acid, Iodine is liberated which can be estimated by titration with Hypo. When a paste of (X) is heated with ethyl alcohol or acetone, a sweet smelling liquid is obtained, which is used as an anaesthetic. Identify (X)

- A) $CaCO_3$ B) $Ca(OH)_2$ C) $Ba(OH)_2$ D) $CaOCl_2$

5) The reaction of ammonium chloride with BCl_3 at $140^\circ C$ followed $NaBH_4$ gives product X. Which of the following statements is/are true for X is

- (i) X is not isoelectronic with benzene
(ii) X undergoes addition reaction with HCl
(iii) Electrophilic substitution reaction on X is much faster than that of benzene.
(iv) X undergoes polymerization at $90^\circ C$.

- A) (i) and (ii) B) (ii) only C) (ii) and (iii) D) (i) and (iv)

6) A mixture of boron trichloride and hydrogen is subjected to silent electric discharge to form A and HCl.

A is mixed with NH_3 and heated to $200^\circ C$ to form B. The formula of B is

- A) B_2H_6 B) B_2O_3 C) H_3BO_3 D) $B_3N_3H_6$

7) Which of the following statements is not correct about potash alum?

- A) Its empirical formula is $KAl(SO_4)_2 \cdot 12H_2O$ B) Its aqueous solutions is basic in nature
 C) It is used in dyeing industries
 D) Its aqueous solutions is acidic in nature

8) Name the structure of silicate in which three oxygen atoms of $[SiO_4]^{4-}$ are shared:

- A) Pyrosilicate B) Sheet silicate C) Linear chain silicate D) Three dimensional sheet silicate

9) Which is incorrect statement

- A) Sn^{2+} and Fe^{3+} cannot co exist in same solution
 B) The sum of oxidation states of carbon in carbon sub oxide is +4 C) PbI_4 does not exist
 D) Hydrocarbons are good reducing agents but not silanes

10) The polymeric silicate of the following in which three oxygens of each SiO_4^{4-} unit cell are shared by other SiO_4^{4-} unit cells is

- A) chain silicates B) frame work silicates C) sheet silicates D) all the above three

11) $\begin{pmatrix} 2 & 3 & 5 \\ 4 & 1 & 2 \\ 1 & 2 & 1 \end{pmatrix} = P + Q$ where P is a symmetric and Q is a skew-symmetric then
 $Q =$

- A) $\begin{pmatrix} 0 & \frac{-1}{2} & 2 \\ \frac{1}{2} & 0 & 0 \\ -2 & 0 & 0 \end{pmatrix}$ B) $\begin{pmatrix} 0 & \frac{1}{2} & 1 \\ \frac{-1}{2} & 0 & 0 \\ -1 & 0 & 0 \end{pmatrix}$ C) $\begin{pmatrix} 0 & 1 & 0 \\ -1 & 0 & 1 \\ 0 & -1 & 0 \end{pmatrix}$ D) $\begin{pmatrix} 0 & 2 & 3 \\ -2 & 0 & 4 \\ -3 & -4 & 0 \end{pmatrix}$

12) If A, B are two matrices such that $AB = B, BA = A$ then $A^2 + B^2 =$

- A) $A + B$ B) $A - B$ C) B D) $2A + B$

13) A and B are two given matrices such that the order of A is 3×4 , if $A'B$ and BA' are both defined then

- A) Order of B' is 3×4 B) Order of $B'A$ is 4×4 C) Order of $B'A$ is 3×3 D) $B'A$ is undefined

14) The value of a third order determinant is 11, then the value of the square of the determinant formed by the cofactors will be

- A) 11 B) 121 C) 1331 D) 14641

15) The determinant $\begin{vmatrix} xp + y & x & y \\ yp + z & y & z \\ 0 & xp + y & yp + z \end{vmatrix} = 0$ then x, y and z are in

- A) x, y, z are in A.P. B) x, y, z are in G.P. C) x, y, z are in H.P. D) xy, yz, zx are in A.P.

16) $(x_1 - x_2)^2 + (y_1 - y_2)^2 = a^2$, $(x_2 - x_3)^2 + (y_2 - y_3)^2 = b^2$ and $(x_3 - x_1)^2 + (y_3 - y_1)^2 = c^2$ then

$$4 \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}^2 =$$

- A) $abc(a + b + c)$ B) $(a + b + c)^4$ C) $(a + b + c)(a + b - c)(b + c - a)(c + a - b)$
D) $(a + b + c)(a^2 + b^2 + c^2)$

17) If $\begin{vmatrix} a & b & 1 \\ b & c & 1 \\ c & a & 1 \end{vmatrix} = 2010$ then $\begin{vmatrix} c - a & c - b & ab \\ a - b & a - c & bc \\ b - c & b - a & ca \end{vmatrix} - \begin{vmatrix} c - a & c - b & c^2 \\ a - b & a - c & a^2 \\ b - c & b - a & b^2 \end{vmatrix} = p$ then number of positive integral divisors of p .

- A) 36 B) 49 C) 64 D) 81

18) The number of 3×3 non-singular matrices with four entries as 1 and all other entries 0, is

- A) 6 B) at least 7 C) less than 4 D) 5

19) If the system of equations $x - cy - bz = 0$, $cx - y - az = 0$, $bx - ay - z = 0$ has a non-zero solution then $a^2 + b^2 + c^2 - 2abc =$

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

20) $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}$, $6A^{-1} = A^2 + cA + dI$, then (c, d)

- A) (-6, 11) B) (-11, 6) C) (11, 6) D) (6, 11)

21) A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2m while applying the force and the ball goes upto 2m height further, find the magnitude of the force. ($g = 10ms^{-2}$)

- A) 20N B) 22N C) 4N D) 16N

22) A ball of mass 10 gm dropped from a height of 5m hits the floor and rebounds to a height of 1.25m. If the ball is in contact with the ground for 0.1s, the force exerted by the ground on the ball is ($g = 10 m/s^2$)

- A) 0.5 N B) 1.5 N C) 0.15N D) 2.5N

23) Two persons are holding a rope of negligible weight tightly at its ends so that it is horizontal. A 15 kg weight is attached to rope at the midpoint which now no more remains horizontal. The minimum tension required to completely straighten the rope is

- A) 150N B) 75N C) 50N D) Infinitely large

24) Three forces $20\sqrt{2} N$, $20\sqrt{2} N$ and $40N$ are acting along x , y and z -axes respectively on a $5\sqrt{2} kg$ mass at rest at the origin. The magnitude of its displacement after 5s is, ℓ meters then $\ell =$

- A) 50 B) 25 C) 60 D) 100

25) A body of mass 5kg starts from the origin with an initial velocity $\vec{u} = 30\hat{i} + 40\hat{j}ms^{-1}$. If a constant force $\vec{F} = -(\hat{i} + 5\hat{j}) N$ acts on the body, the time in which the y -component of the velocity becomes zero is ℓ seconds then $\ell =$

- A) 5 B) 20 C) 40 D) 80

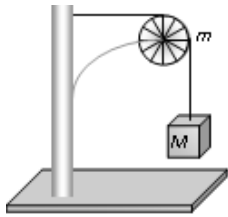
26) A horizontal jet of water coming out of a pipe of the area of cross-section 20cm^2 hits a vertical wall with a velocity of 10m.s^{-1} and rebounds with the same speed. The force exerted by water on the wall is k newtons then $k =$

- A) 0.2 B) 10 C) 400 D) 200

27) The displacement of a body moving along a straight line is given by $S = bt^n$, where 'b' is a constant and 't' is time. For what value of 'n' the body moves under the action of constant force?

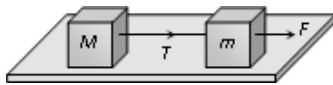
- A) $\frac{3}{2}$ B) 1 C) 2 D) $\frac{1}{2}$

28) A string of negligible mass going over a clamped pulley of mass m supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by



- A) $\sqrt{2}Mg$ B) $\sqrt{2}mg$ C) $\sqrt{(mg)^2 + (M+m)g^2}$ D) $\sqrt{((M+m)g)^2 + (Mg)^2}$

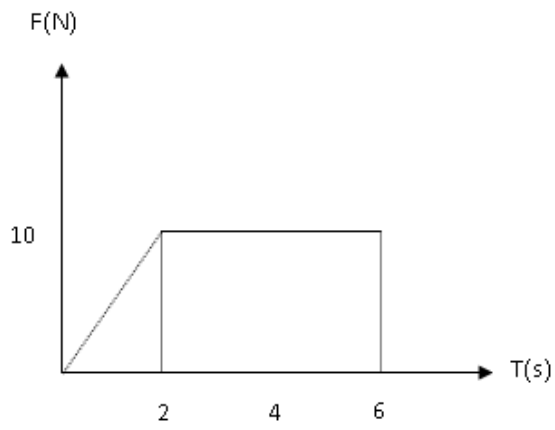
29) Two masses M and m are connected by a weightless string. They are pulled by a force F on a frictionless horizontal surface. The tension in the string will be



- A) $\frac{FM}{m+M}$ B) $\frac{F}{M+m}$ C) $\frac{FM}{m}$ D) $\frac{Fm}{M+m}$

30)

A body of mass 3kg is acted on by a force which varies as shown in the graph below. The momentum acquired is given by



- A) Zero B) 5 N-s C) 30N-s D) 50 N-s