



# BJNP

Learning with the Speed of Mumbai and the Tradition of Kota



Max Marks:200

Date: 07.08.2022

**ARJUNA BATCH**  
**CHEMISTRY: PART TEST**  
**Topic: (Solution + Nitrogen + Oxygen)**

- The basic character of hydrides of the V-group elements decreases in the order  
(a)  $\text{SbH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{NH}_3$  (b)  $\text{NH}_3 > \text{SbH}_3 > \text{PH}_3 > \text{AsH}_3$   
(c)  $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3$  (d)  $\text{SbH}_3 > \text{AsH}_3 > \text{PH}_3 > \text{NH}_3$
- Which of the following elements of group VA does not show allotropy  
(a) N (b) Bi (c) P (d) As
- Pure  $\text{N}_2$  gas is obtained from  
(a)  $\text{NH}_3 + \text{NaNO}_2$  (b)  $\text{NH}_4\text{Cl} + \text{NaNO}_2$  (c)  $\text{N}_2\text{O} + \text{Cu}$  (d)  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$
- The oxyacid of phosphorus, in which phosphorus has the lowest oxidation state, is  
(a) Hypophosphorus acid (b) Orthophosphoric acid  
(c) Pyrophosphoric acid (d) Metaphosphoric acid
- White phosphorus reacts with caustic soda. The products are  $\text{PH}_3$  and  $\text{NaH}_2\text{PO}_2$ . This reaction is an example of  
(a) Oxidation (b) Reduction  
(c) Oxidation and reduction (d) Neutralization
- Phosphine is generally prepared in the laboratory  
(a) By heating phosphorus in a current of hydrogen  
(b) By heating white phosphorus with aqueous solution of caustic potash  
(c) By decomposition of  $\text{P}_2\text{H}_4$  at  $110^\circ\text{C}$   
(d) By heating red phosphorus with an aqueous solution of caustic soda
- Sulphuric acid reacts with  $\text{PCl}_5$  to give  
(a) Thionyl chloride (b) Sulphur monochloride  
(c) Sulphuryl chloride (d) Sulphur tetrachloride

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**Space for Rough Work**



# B.J.N.P

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8. Aqueous solutions of hydrogen sulphide and sulphur dioxide when mixed together yield
- (a) Sulphur and water (b) Sulphur and trioxide and water  
(c) Hydrogen peroxide and sulphur (d) Hydrogen and sulphurous acid
9. At room temperature  $\text{H}_2\text{O}$  is a liquid while  $\text{H}_2\text{S}$  is a gas. The reason is
- (a) Electronegativity of O is greater than S  
(b) Difference in the bond angles of both the molecules  
(c) Association takes place in  $\text{H}_2\text{O}$  due to H-bonding while there is no H-bonding in  $\text{H}_2\text{S}$   
(d) O and S belong to different periods.
10. Conc.  $\text{H}_2\text{SO}_4$  is diluted
- (a) By adding water in  $\text{H}_2\text{SO}_4$  (b) By adding  $\text{H}_2\text{SO}_4$  in water  
(c) By adding glacial acetic acid in  $\text{H}_2\text{SO}_4$  (d) None of the above
11. Bleaching action of  $\text{SO}_2$  is due to
- (a) Reduction (b) Oxidation (c) Hydrolysis (d) Its acidic nature
12.  $\text{SO}_2$  is obtained when
- (a) Oxygen reacts with dilute sulphuric acid  
(b) Hydrolysis of dilute  $\text{H}_2\text{SO}_4$   
(c) Concentrated  $\text{H}_2\text{SO}_4$  reacts with  $\text{Na}_2\text{SO}_3$   
(d) All of these
13. Which of the following is oxidized by  $\text{SO}_2$ .
- (a) Mg (b)  $\text{K}_2\text{Cr}_2\text{O}_7$  (c)  $\text{KMnO}_4$  (d) All of these
14. The difference between the boiling point and freezing point of an aqueous solution containing sucrose (molecular wt. =  $342 \text{ g mol}^{-1}$ ) in 100 g of water is  $105^\circ \text{C}$ . If  $K_f$  and  $K_b$  of water are  $1.86$  and  $0.51 \text{ K kg mol}^{-1}$  respectively. the weight of sucrose in solution is about
- (a) 34.2 g (b) 342 g (c) 7.2 g (d) 72 g  
(e) 68.4 g

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15. The amount of solute (Molar mass  $60 \text{ g mol}^{-1}$ ) that must be added to 180g of water so that the vapour pressure of water is lowered by 10% is  
(a) 30 g                      (b) 60 g                      (c) 120 g                      (d) 12 g  
(e) 24 g
16. A 6% solution of urea is isotonic with  
(a) 0.05 M solution of glucose                      (b) 6% solution of glucose  
(c) 25% solution of glucose                      (d) 1 M solution of glucose
17. Consider the following aqueous solution and assume 100% ionization of electrolytes  
(I) 0.1 m urea                      (II) 0.04 m  $\text{Al}_2(\text{SO}_4)_3$                       (III) 0.05 m  $\text{CaCl}_2$                       (IV) 0.005 m  $\text{NaCl}$   
The correct statement regarding the above solutions is  
(a) freezing point will be lowest for solution I  
(b) freezing point will be highest for solution II  
(c) vapour pressure will be highest for solution II  
(d) osmotic pressure will be highest for solution III
18. Which one of the following statements is false ?  
(a) Raoult's law states that the vapour pressure of a component over a binary solution of volatile liquids is directly proportional to its mole fraction.  
(b) Two sucrose solutions of the same molality prepared in different solvents will have the same depression of freezing point.  
(c) The correct order of osmotic pressures of 0.01 M solution of each compound is  $\text{BaCl}_2 > \text{KCl} > \text{CH}_3\text{COOH} > \text{glucose}$   
(d) In the equation osmotic pressure  $p = MRT$ , M is the molarity of the solution.  
(e) The molecular weight of  $\text{NaCl}$  determined by colligative property measurement is less than its theoretical molecular weight.
19. Two solutions of a substance (non-electrolyte) are mixed in the following manner.  
480 mL of 1.5 M first solution + 520 mL of 1.2 M second solution. What is the molarity of the final mixture?  
(a) 1.20 M                      (b) 1.50 M                      (c) 1.344 M                      (d) 2.70 M

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20. Equimolar solution in the same solvent have
- (a) same boiling point but different freezing point
  - (b) same freezing point but different boiling point
  - (c) same boiling point and same freezing point
  - (d) different boiling point and different freezing point.
21. The pentavalence in phosphorus is more stable as compared to that of nitrogen even though they belong to the same group. It is due to
- (a) Inert nature of nitrogen
  - (b) Reactivity of phosphorus
  - (c) Larger size of phosphorus atom
  - (d) Dissimilar electronic configuration
22. On adding excess of ammonium hydroxide to a copper chloride solution.
- (a) A deep blue solution is obtained
  - (b) No change is observed
  - (c) Blue precipitate of copper hydroxide is obtained
  - (d) Black precipitate of copper oxide is obtained

**Single Digit Integer**

23. Number of  $\pi$  – bonds are present in Marshall's acid is \_\_\_\_\_.
24. Number of oxygen atom produced when ozone reacts with dry iodine to form oxide is \_\_\_\_\_.
25. How many moles of water reacts with one mole of  $\text{PCl}_5$  for complete hydrolysis?

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**[SINGLE CORRECT CHOICE TYPE]**

**Q.1 to Q.25** has four choices (A), (B), (C), (D) out of which **ONLY ONE** is correct.

- Q.1 The intervals of increase of  $f(x)$  defined by  $f(x) = \int_{-1}^x (t^2 + 2t)(t^2 - 1) dt$  is equal to
- (A)  $\left(-\infty, \frac{-3}{2}\right) \cup (0, 3) \cup (10, \infty)$       (B)  $(-\infty, -2) \cup \left(\frac{-1}{2}, \frac{1}{2}\right) \cup (4, \infty)$
- (C)  $(-\infty, -2) \cup (-1, 0) \cup (1, \infty)$       (D)  $(-\infty, -2) \cup \left(\frac{-3}{4}, \frac{1}{4}\right) \cup (1, \infty)$
- Q.2 If Mean value theorem holds good for the function  $f(x) = \frac{x-1}{x}$  on the interval  $[1, 3]$  then the value of 'c' is
- (A) 2      (B)  $\frac{1}{\sqrt{3}}$       (C)  $\frac{2}{\sqrt{3}}$       (D)  $\sqrt{3}$
- Q.3 Let  $f(x)$  and  $g(x)$  be two continuous functions defined from  $\mathbb{R} \rightarrow \mathbb{R}$ , such that  $f(x_1) > f(x_2)$  and  $g(x_1) < g(x_2)$ ,  $\forall x_1 > x_2$ , then solution set of  $f(g(\alpha^2 - 2\alpha)) > f(g(3\alpha - 4))$  is
- (A)  $\mathbb{R}$       (B)  $\emptyset$       (C)  $(1, 4)$       (D)  $\mathbb{R} - [1, 4]$
- Q.4 Let  $f(x) = x + \sqrt{x}$  on  $[1, 4]$ . The mean value theorem says that there must be some number 'c' between 1 and 4 so that  $f'(c)$  is equal to the average slope of  $f(x)$  on  $[1, 4]$ . the number 'c' must be
- (A)  $\frac{5}{2}$       (B)  $\frac{9}{4}$       (C)  $\frac{11}{4}$       (D) 3



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- Q.5 If the function  $f(x) = 2x^2 + 3x + 5$  satisfies LMVT at  $x = 2$  on the closed interval  $[1, a]$  then the value of 'a' is equal to  
(A) 3 (B) 4 (C) 6 (D) 1
- Q.6 Consider the function  $f(x) = 8x^2 - 7x + 5$  on the interval  $[-6, 6]$ . The value of c that satisfies the conclusion of the mean value theorem, is  
(A)  $-7/8$  (B)  $-4$  (C)  $7/8$  (D) 0
- Q.7 If  $f(x) = x^3 + ax^2 + bx + 5 \sin^2 x$  is a strictly increasing function on the set of real numbers then a and b must satisfy the relation  
(A)  $a^2 - 3b + 15 \leq 0$  (B)  $a^2 - 3b + 20 \leq 0$   
(C)  $a^2 - 3b + 25 \leq 0$  (D)  $a^2 - 3b + 30 \leq 0$

Q.8 Given:  $f(x) = 4 - \left(\frac{1}{2} - x\right)^{2/3}$   $g(x) = \begin{cases} \frac{\tan [x]}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$

$$h(x) = \{x\}$$

$$k(x) = 5^{\log_2(x+3)}$$

then in  $[0, 1]$ , Lagrange's Mean Value Theorem is NOT applicable to

- (A) f, g, h (B) h, k (C) f, g (D) g, h, k

where  $[x]$  and  $\{x\}$  denotes the greatest integer and fraction part function.



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Q.9 If  $f(x) = 1 + x + \int_1^x (\ln^2 t + 2/\ln t) dt$ , then  $f(x)$  increases in

- (A)  $(0, \infty)$  (B)  $(0, e^{-2}) \cup (1, \infty)$  (C) no value (D)  $(1, \infty)$

Q.10 Let  $f(x) = \begin{cases} x^\alpha \sin\left(\frac{1}{x}\right) \sin \pi x & ; x \neq 0 \\ 0 & ; x = 0 \end{cases}$ .

If Rolle's theorem is applicable to  $f(x)$  on  $[0, 1]$  then range of  $\alpha$  is

- (A)  $-\infty < \alpha < -1$  (B)  $\alpha = 1$  (C)  $-1 < \alpha < \infty$  (D)  $\alpha \geq 0$

Q.11 If  $f(x) = a^{\{a^{|x|} \operatorname{sgn} x\}}$ ;  $g(x) = a^{\lceil a^{|x|} \operatorname{sgn} x \rceil}$  for  $a > 0$ ,  $a \neq 1$  and  $x \in \mathbb{R}$ , where  $\{\}$  &  $\lceil \rceil$  denote the fractional part and integral part functions respectively, then which of the following statements can hold good for the function  $h(x)$ , where

$$(\ln a) h(x) = (\ln f(x) + \ln g(x)).$$

- (A) 'h' is even and increasing (B) 'h' is odd and decreasing  
(C) 'h' is even and decreasing (D) 'h' is odd and increasing. Q.7 If  $f(x) = x^3 + ax^2 + bx + 5 \sin^2 x$  is a strictly increasing function on the set of real numbers then a and b must satisfy the relation

- (A)  $a^2 - 3b + 15 \leq 0$  (B)  $a^2 - 3b + 20 \leq 0$   
(C)  $a^2 - 3b + 25 \leq 0$  (D)  $a^2 - 3b + 30 \leq 0$



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Q.12 Number of critical points of the function,  $f(x) = \frac{2}{3}\sqrt{x^3} - \frac{x}{2} + \int_1^x \left(\frac{1}{2} + \frac{1}{2}\cos 2t - \sqrt{t}\right) dt$

which lie in the interval  $[-2\pi, 2\pi]$  is

- (A) 2                      (B) 4                      (C) 6                      (D) 8

Q.13 Consider  $f(x) = |1 - x|$   $1 \leq x \leq 2$  and

$$g(x) = f(x) + b \sin \frac{\pi}{2} x, \quad 1 \leq x \leq 2$$

then which of the following is correct?

(A) Rolles theorem is applicable to both  $f$ ,  $g$  and  $b = \frac{3}{2}$

(B) LMVT is not applicable to  $f$  and Rolles theorem if applicable to  $g$  with  $b = \frac{1}{2}$

(C) LMVT is applicable to  $f$  and Rolles theorem is applicable to  $g$  with  $b = 1$

(D) Rolles theorem is not applicable to both  $f$ ,  $g$  for any real  $b$ .

Q.14 If  $f$  be a continuous function on  $[0, 1]$ , differentiable in  $(0, 1)$  such that  $f(1) = 0$ , then there exists some  $c \in (0, 1)$  such that

(A)  $c f'(c) - f(c) = 0$

(B)  $f'(c) + c f(c) = 0$

(C)  $f'(c) - c f(c) = 0$

(D)  $c f'(c) + f(c) = 0$





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Q.15 Range of the function  $f(x) = \frac{\ln x}{\sqrt{x}}$  is

- (A)  $(-\infty, e)$       (B)  $(-\infty, e^2)$       (C)  $\left(-\infty, \frac{2}{e}\right]$       (D)  $\left(-\infty, \frac{1}{e}\right)$

Q.16 In which one of the following intervals Rolle's theorem hold(s) good for  $y = x^2 \sin \frac{1}{x} + x^3 \cos$

$$\frac{1}{2x}.$$

- (A)  $\left[\frac{1}{\pi}, \frac{2}{\pi}\right]$       (B)  $\left[\frac{1}{3\pi}, \frac{1}{\pi}\right]$       (C)  $\left[\frac{1}{2\pi}, \frac{1}{\pi}\right]$       (D)  $\left[\frac{1}{\pi}, \frac{3}{\pi}\right]$

Q.17 The set of values of  $p$  for which the equation  $|\ln x| - px = 0$  possess three distinct roots is

- (A)  $\left(0, \frac{1}{e}\right)$       (B)  $(0, 1)$       (C)  $(1, e)$       (D)  $(0, e)$

Q.18 Let  $f(x)$  and  $g(x)$  be two differentiable function in  $\mathbb{R}$  and  $f(2) = 8$ ,  $g(2) = 0$ ,  $f(4) = 10$  and  $g(4) = 8$  then

- (A)  $g'(x) > 4f'(x) \quad \forall x \in (2, 4)$       (B)  $3g'(x) = 4f'(x)$  for at least one  $x \in (2, 4)$   
(C)  $g(x) > f(x) \quad \forall x \in (2, 4)$       (D)  $g'(x) = 4f'(x)$  for at least one  $x \in (2, 4)$



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- Q.19 For  $0 < a \leq 1$  and  $b \in \mathbb{R}$ , then in  $(-a, a)$  the function,  $f(x) = ax^3 - 3ax + b$   
(A) has exactly 2 roots. (B) can not have a root.  
(C) has at most one root. (D) more than two roots.

- Q.20 Number of roots of the function  $f(x) = \frac{1}{(x+1)^3} - 3x + \sin x$  is  
(A) 0 (B) 1 (C) 2 (D) more than 2

- Q.21 Which one of the following functions Rolle's theorem is applicable?

(A)  $f(x) = \begin{cases} x, & 0 \leq x < 1 \\ 0, & x = 1 \end{cases}$  on  $[0, 1]$  (B)  $f(x) = \begin{cases} \frac{\sin x}{x}, & -\pi \leq x < 0 \\ 0, & x = 0 \end{cases}$  on  $[-\pi, 0]$

(C)  $f(x) = \frac{x^2 - x - 6}{x - 1}$  on  $[-2, 3]$

(D)  $f(x) = \begin{cases} \frac{x^3 - 2x^2 - 5x + 6}{x - 1} & \text{if } x \neq 1, \text{ on } [-2, 3] \\ -6 & \text{if } x = 1 \end{cases}$

- Q.22 Suppose that  $f(0) = -3$  and  $f'(x) \leq 5$  for all values of  $x$ . Then the largest value which  $f(2)$  can attain is  
(A) 7 (B) -7 (C) 13 (D) 8



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- Q.23 If the equation  $x^4 + 8x^3 + 18x^2 + 8x + a = 0$  has four distinct real roots, then the range of  $a$  is  
(A)  $(0, 9)$                       (B)  $(-9, 0)$                       (C)  $(-8, 1)$                       (D)  $(-1, 8)$
- Q.24 The smallest natural number  $c$  for which the equation  $e^x = cx^2$  has exactly three real and distinct solutions, is  
(A) 1                                  (B) 2                                  (C) 3                                  (D) 4
- Q.25 If  $P(x) = (2013)x^{2012} - (2012)x^{2011} - 16x + 8$ , then  $P(x) = 0$  for  $x \in \left[0, 8^{\frac{1}{2011}}\right]$  has  
(A) exactly one real root.                      (B) no real root.  
(C) atleast one and at most two real roots.                      (D) atleast two real roots.



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**ARJUNA BATCH**  
**CHEMISTRY: PART TEST ANSWER KEY**  
**Topic: Topic: (Solution + Nitrogen + Oxygen)**

1.	(c)	2.	(b)	3.	(b)	4.	(a)	5.	(c)
6.	(b)	7.	(c)	8.	(a)	9.	(c)	10.	(b)
11.	(a)	12.	(b,c)	13.	(a)	14.	(d)	15.	(b)
16.	(d)	17.	(b)	18.	(b)	19.	(c)	20.	(c)
21.	(c)	22.	(a)	23.	(4)	24.	(9)	25.	(4)

**ARJUNA BATCH**  
**MATHEMATICS : PART TEST ANSWER KEY**  
**Topic: Monotonicity**

1.	(c)	2.	(d)	3.	(c)	4.	(b)	5.	(a)
6.	(d)	7.	(a)	8.	(a)	9.	(a)	10.	(c)
11.	(d)	12.	(b)	13.	(c)	14.	(d)	15.	(c)
16.	(b)	17.	(a)	18.	(d)	19.	(c)	20.	(c)
21.	(d)	22.	(a)	23.	(c)	24.	(b)	25.	(d)