



**Max Marks: 60**

**Date: 13.08.2022**

**ABHIMANYU BATCH**  
**CHEMISTRY: DCT**  
**Topic: Boron + Carbon + Solutions**

1. Consider the following boron halides  

1. $\text{BF}_3$	2. $\text{BCl}_3$	3. $\text{BBr}_3$	4. $\text{BI}_3$
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The Lewis acid characters of these halides are such that  
 (a)  $1 < 2 < 3 < 4$       (b)  $1 < 3 < 2 < 4$       (c)  $4 < 3 < 2 < 1$       (d)  $4 < 2 < 3 < 1$
2.  $\text{H}_3\text{BO}_3$  and  $\text{HBO}_2$  do not differ in  
 (a) oxidation number      (b) basicity      (c) melting point      (d) structure
3. Thermite welding uses Al because of  
 (a) its low melting point      (b) its lightness  
 (c) its greater affinity for oxygen      (d) All the properties given above
4. Which of the following statements about  $\text{H}_3\text{BO}_3$  is not correct.  
 (a) It is strong tribasic acid  
 (b) It is prepared by acidifying an aqueous solution of borax.  
 (c) It has a layer structure in which planar  $\text{BO}_3$  units are joined by hydrogen bonds.  
 (d) It does not act as a Lewis acid by accepting hydroxyl ion
5. Reactivity of borazole is greater than that of benzene because  
 (a) borazole is polar compound      (b) borazole is non-polar compound  
 (c) borazole is electron deficient compound      (d) of localized electrons in it
6. Dry ice is  
 (a)  $\text{H}_2\text{O}(\text{s})$       (b)  $\text{NH}_3(\text{g})$       (c)  $\text{CO}_2(\text{s})$       (d)  $\text{PH}_3(\text{g})$
7. Out of  $\text{CO}_2$ ,  $\text{SiO}_2$ ,  $\text{GeO}_2$ ,  $\text{SnO}_2$  and  $\text{PbO}_2$   
 (a)  $\text{CO}_2$  and  $\text{SiO}_2$  are acidic,  $\text{SnO}_2$  is amphoteric and  $\text{PbO}_2$  is an oxidizing agent.  
 (b)  $\text{PbO}_2$  is converted to  $\text{Pb}(\text{NO}_3)_2$  on reaction with  $\text{HNO}_3$   
 (c) Both (a) and (b) are correct  
 (d) None of the above is correct

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**Space for Rough Work**



8. Which is/are true statements?
- (a) Diamond is unaffected by conc acids but graphite reacts with hot conc.  $\text{HNO}_3$  forming mellitic acid,  $\text{C}_6(\text{COOH})_6$
- (b) CO is toxic because it forms a complex with hemoglobin in the blood.
- (c)  $\text{C}_3\text{O}_2$ , carbon suboxide, is a foul-smelling gas
- (d) All the above are true statements.
9. Gas that strikes in thundering of light is
- (a) CO (b) NO (c)  $\text{CO}_2$  (d)  $\text{H}_2$
10. White lead is
- (a)  $\text{PbSO}_4, \text{PbO}$  (b)  $\text{PbCO}_3, \text{PbO}$  (c)  $\text{PbCO}_3$  (d)  $\text{Pb(OH)}_2, \text{PbCO}_3$
11. The order of boiling points of four equimolar aqueous solutions is  $C < B < A < D$ . The correct order of their freezing points is
- (a)  $D < C < B < A$  (b)  $D > C < B < A$  (c)  $D < B > A < C$  (d)  $D > A > B > C$
12. Which of the following pair of solutions are expected to isotonic at the same temperature ?
- (a) 0.2 M urea and 0.2 M NaCl (b) 0.1 M urea and 0.2 M  $\text{MgCl}_2$
- (c) 0.1 M NaCl and 0.1 M  $\text{Na}_2\text{SO}_4$  (d) 0.1 M  $\text{Ca(NO}_3)_2$  and 0.1 M  $\text{Na}_2\text{SO}_4$
13. In countries nearer to polar region, the roads are sprinkled with  $\text{CaCl}_2$ . This is
- (a) to minimize the snow fall (b) to minimize pollution
- (c) to minimize the accumulation of dust on the road (d) to minimize the wear and tear of the roads.
14. 1 mole each of the following solutes are taken in 5 moles water,
- A. NaCl B.  $\text{K}_2\text{SO}_4$  C.  $\text{Na}_3\text{PO}_4$  D. glucose
- Assuming 100% ionisation of the electrolyte, relative decreases in vapour pressure will be in the order
- (a)  $A < B < C < D$  (b)  $D < C < B < A$  (c)  $D < A < B < C$  (d) equal
15. Osmosis results from
- (a) an increase in entropy (b) a decrease in entropy
- (c) a decrease in enthalpy (d) a decrease in internal energy

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**Space for Rough Work**

**BJNP***Learning with the Speed of Mumbai and the Tradition of Kota***Max Marks: 60****Date: 13.08.2022****ABHIMANYU BATCH  
MATHEMATICS : DCT****Topic: Rolle's Theorem, Mean Value Theorem**

16. If the function  $f(x) = x^3 - 6x^2 + ax + b$  defined on  $[1, 3]$  satisfies the Rolle's Theorem for  $c = \frac{2\sqrt{3}+1}{\sqrt{3}}$ , then
- (a)  $a = 11, b \in \mathbb{R}$       (b)  $a = -11, b = 6$       (c)  $a = 11, b = 6$       (d) none of these
17. Which condition of Rolle's Theorem is not satisfied the function  $f(x) = [x]$ , where  $x \in [-1, 1]$  ?
- (a)  $f(x)$  is not derivable at  $x = 1$       (b)  $f(x)$  is not derivable at  $x = -1$   
(c)  $f(x)$  is not continuous at  $x = 0$       (d) none of these
18. If  $f$  is differentiable for all  $x$  and  $f(1) = -2$  while  $f'(x) \geq 2$  for all  $x \in [1, 6]$ , then
- (a)  $f(6) < 8$       (b)  $f(6) \geq 8$       (c)  $f(6) \geq 5$       (d)  $f(6) \leq (5)$
19. If  $a, b$  are two distinct zeroes of a polynomial  $f(x)$ , then there is at least one zero between  $a$  and  $b$  of the polynomial
- (a)  $f(x)$       (b)  $f'(x)$       (c)  $f''(x)$       (d) none of these
20. If, from mean value theorem,  $f(x_1) = \frac{f(b) - f(a)}{b - a}$ , then
- (a)  $a < x_1 \leq b$       (b)  $a \leq x_1 < b$       (c)  $a < x_1 < b$       (d)  $a \leq x_1 \leq b$
21. Let  $f(x)$  and  $g(x)$  be defined and  $g(x)$  be defined and differentiable for  $x \geq x_0$ . If  $f(x_0) = g(x_0)$  and  $f'(x) > g'(x)$  for all  $x > x_0$ , then
- (a)  $f(x) < g(x)$  for some  $x > x_0$       (b)  $f(x) = g(x)$  for some  $x > x_0$   
(c)  $f(x) > g(x)$  for all  $x > x_0$       (d) none of these

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**Space for Rough Work**



22. For which of the following function is Rolle's Theorem not applicable?  
 (a)  $f(x) = 3 + (x - 1)^{2/3}$  on  $[0, 3]$  (b)  $f(x) = e^{1-x^3}$  on  $[-1, 1]$   
 (c)  $f(x) = \log(x^2 + 2) - \log 3$  on  $[-1, 1]$  (d)  $f(x) = \sqrt{4 - x^2}$  on  $[-2, 2]$
23. If Rolle's Theorem holds for the function  $f(x) = x^3 + bx^2 + cx$ ,  $1 \leq x \leq 2$  at the point  $x = 4/3$ , then  
 (a)  $b = 8, c = -5$  (b)  $b = -5, c = 8$  (c)  $a = -2/3, b = 1$  (d)  $a = 2/3, b = 1$
24. For which of the following functions is Rolle's Theorem not applicable?  
 (a)  $f(x) = x^{1/3}$  on  $[-1, 1]$  (b)  $f(x) = |x|$  on  $[1, 2]$   
 (c)  $f(x) = \tan^{-1}x$  on  $[0, 1]$  (d)  $f(x) = x + \frac{1}{x}$  on  $[1/2, 3]$
25. Which condition of Rolle's Theorem is not satisfied for the function  $f(x) = |x|$  on  $[-1, 1]$ ?  
 (a)  $f(x)$  is not differentiable at  $x = 1$  (b)  $f(x)$  is not continuous at  $x = -1$   
 (c)  $f(x)$  is not continuous at  $x = 0$  (d)  $f(x)$  is not differentiable at  $x = 0$
26. If  $2a + 3b + 6c = 0$ , then at least one root of the equation  $ax^2 + bx + c = 0$  lies in the interval  
 (a)  $(0, 1)$  (b)  $(1, 2)$  (c)  $(2, 3)$  (d) none of these
27. If  $\frac{a_0}{n+1} + \frac{a_1}{n} + \frac{a_2}{n-1} + \dots + \frac{a_n-1}{2} + a_n = 0$ , then in  $(0, 1)$  the function  $f(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \dots + a_n$  has  
 (a) at least one zero (b) at most one zero (c) only 3 zeroes (d) only 2 zeroes
28. If  $f(x) = (x - 4)(x - 5)(x - 6)(x - 7)$ , then  
 (a)  $f'(x) = 0$  has 4 roots (b)  $f'(x)$  has 3 zeroes in  $(4, 5) \cup (5, 6) \cup (6, 7)$   
 (c)  $f'(x) = 0$  has only one root (d)  $f'(x)$  has 3 zeroes in  $(3, 4) \cup (4, 5) \cup (5, 6)$
29. The equation  $3x^2 + 4ax + b = 0$  has at least one root in  $(0, 1)$  if  
 (a)  $4a + b + 3 = 0$  (b)  $2a + b + 1 = 0$  (c)  $a = -4/3, b = 0$  (d) none of these
30. If  $f(x) = (x - 1)(x - 2)(x - 3)$  on  $[0, 4]$ , then the value of 'c' by Mean Value Theorem is  
 (a)  $2 + (\sqrt{3}/2)$  (b)  $3 \pm (2/\sqrt{3})$  (c)  $2 \pm (2/\sqrt{3})$  (d) none of these

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**CHEMISTRY: DCT ANSWER KEY**  
**Topic: Boron + Carbon + Solutions**

1.	(c)	2.	(a)	3.	(c)	4.	(a)	5.	(d)
6.	(c)	7.	(c)	8.	(d)	9.	(b)	10.	(d)
11.	(c)	12.	(d)	13.	(a)	14.	(c)	15.	(b)

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**ABHIMANYU BATCH**  
**MATHEMATICS : DCT ANSWER KEY**  
**Topic: Rolle's Theorem, Mean Value Theorem**

16.	(a)	17.	(c)	18.	(b)	19.	(b)	20.	(c)
21.	(c)	22.	(a)	23.	(b)	24.	(a)	25.	(d)
26.	(a)	27.	(a)	28.	(b)	29.	(b)	30.	(c)