SURFACE CHEMISTRY

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1. The mass of gas adsorbed, x per unit mass of adsorbate, m was measured at various pressures, p. A graph between $\log\frac{x}{m}$ and $\log p$ gives a straight line with slope equal to 2 and the intercept equal to 0.4771. The value of $\frac{x}{m}$ at a pressure of 4 atm is

   [Given, log 3 = 0.4771)

   (a) 48 (b) 61
   (c) 74 (d) None of these

2. Which of the following is used for the preparation of colloids?

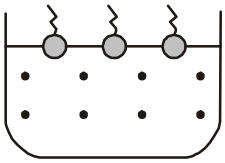
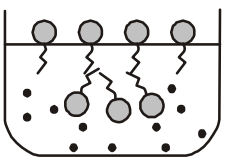
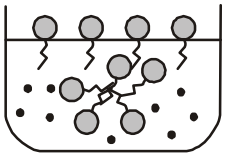
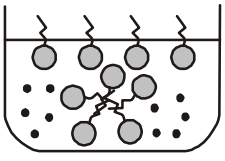
   (a) Bredig's Arc method (b) Ostwald process
   (c) Mond process (d) van Arkel method

3. Amongst the following statements regarding adsorption, those that are valid are:

   (A) ΔH becomes less negative as adsorption proceeds
   (B) On a given adsorbent, ammonia is adsorbed more than nitrogen gas.
   (C) On adsorption, the residual force acting along the surface of the adsorbent increases.
   (D) With increase in temperature, the equilibrium concentration of adsorbate increases.

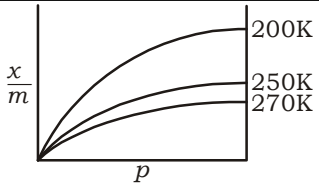
   (a) (D) and (A) (b) (B) and (C)
   (c) (A) and (B) (d) (C) and (D)

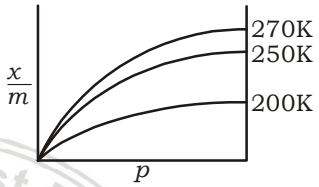
4. Identify the correct molecular picture showing what happens at the critical micellar concentration (CMC) of an aqueous solution of a surfactant (polar head; - non-polar tail; • water).

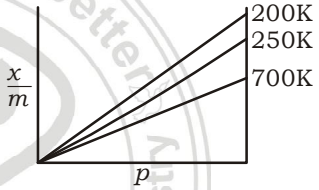
   (A) 
   (B) 
   (C) 
   (D) 

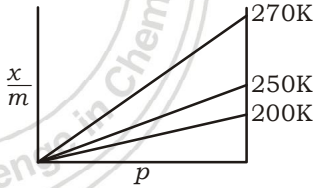
   (a) (C) (b) (B)
   (c) (D) (d) (A)

5. Adsorption of a gas follows Freundlich adsorption isotherm. If x is the mass of the gas adsorbed on mass m of the adsorbent, the correct plot of $\frac{x}{m}$ versus p is

   (a) 

   (b) 

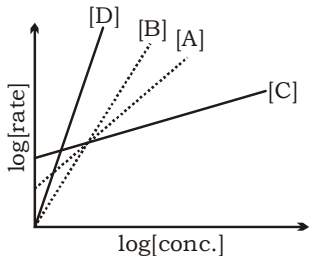
   (c) 

   (d) 

6. Consider the following reactions

   $A \to P1; B \to P2; C \to P3; D \to P4$,

   The order of the above reactions are *a, b, c* and *d*, respectively. The following graph is obtained when log[rate] vs log[conc.] are plotted:



   Among the following, the correct sequence for the order of the reactions is

   (a) D > A > B > C (b) A > B > C > D
   (c) C > A > B > D (d) D > B > A > C

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7. Kraft temperature is the temperature
   (a) below which the aqueous solution of detergents starts freezing
   (b) below which the formation of micelles takes place
   (c) above which the aqueous solution of detergents starts boiling
   (d) above which the formation of micelles takes place

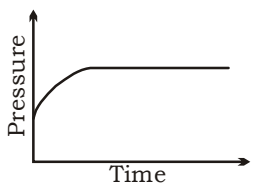
8. For Freundlich adsorption isotherm, a plot of $\log\left(\frac{x}{m}\right)$ (y-axis) and log p (x-axis) gives a straight line. The intercept and slope for the line is 0.4771 and 2, respectively. The mass of gas, adsorbed per gram of adsorbent if the initial pressure is 0.04 atm, is ..... × 10^{-4} g. (log 3 =0.4771)
   (a) 48 (b) 42
   (c) 40 (d) 47

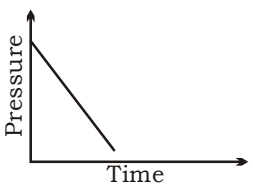
9. The flocculation value of HCl for arsenic sulphide sol. is 30 m mol L^{-1}. If H_2SO_4 is used for the flocculation of arsenic sulphide, the amount in grams of H_2SO_4 is 250 mL required for the above purpose is.....
   (molecular mass of H_2SO_4 = 98 g/mol)
   (a) 0.27 (b) 0.37
   (c) 0.48 (d) None of these

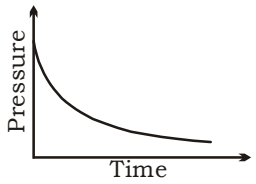
10. As per Hardy-Schulze formation, the flocculation values of the following for ferric hydroxide sol are in the order:
   (a) $K_3[Fe(CN)_6] < K_2CrO_4 < AlCl_3 < KBr > KNO_3$
   (b) $AlCl_3 > K_3[Fe(CN)_6] > K_2CrO_4 > KBr = KNO_3$
   (c) $K_3[Fe(CN)_6] < K_2CrO_4 < KBr = KNO_3 = AlCl_3$
   (d) $K_3[Fe(CN)_6] > AlCl_3 > K_2CrO_4 > KBr > KNO_3$

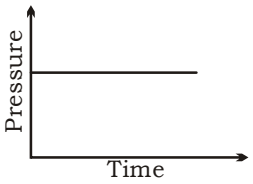
11. For the following Assertion and Reason the correct option is
   Assertion: For hydrogenation reactions, the catalytic activity increases from Group 5 to Group 11 metals with maximum activity shown by Group 7 - 9 elements.
   Reason: The reactants are most strongly adsorbed on group 7 - 9 elements.
   (a) The Assertion is true, but the Reason is false.
   (b) Both Assertion and Reason are true, but the Reason is not the correct explanation for the Assertion.
   (c) Both Assertion and Reason are ture and the Reason is the correct explanation for the Assertion.
   (d) Both Assertion and Reason are false.

12. A mixture of gases O_2, H_2 and CO are taken in a closed vessel containing charcoal. The graph that represents the correct behaviour of pressure with time is

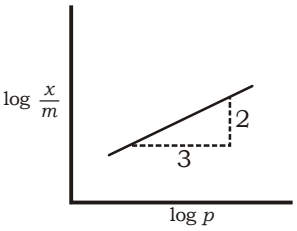
(a) 

(b) 

(c) 

(d) 

13. Adsorption of a gas follows Freundlich adsorption isotherms. x is the mass of the gas adsorbed on mass m of the adsorbent. The plot of $\log\frac{x}{m}$ versus log p is shown in the given graph. $\frac{x}{m}$ is proportional to



   (a) $p^{2/3}$ (b) $p^{3/2}$
   (c) p^3 (d) p^2

14. The aersol is a kind of colloid in which
   (a) gas is dispersed in liquid
   (b) gas is dispersed in solid
   (c) liquid is dispersed in water
   (d) solid is dispersed in gas

15. Match the catalysts Column I with products Column II.

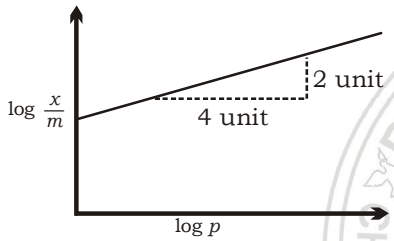
Column I (Catalyst)	**Column II (Product)**
(A) V_2O_5	(i) Polyethlyene
(B) $TiCl_4/Al(Me)_3$	(ii) Ethanal
(C) $PbCl_2$	(iii) H_2SO_4
(D) Iron oxide	(iv) NH_3

   (a) (A) - (ii), (B) - (iii), (C) - (i), (D) - (iv)
   (b) (A) - (iv), (B) - (iii), (C) - (ii), (D) - (i)
   (c) (A) - (iii), (B) - (i), (C) - (ii), (D) - (iv)
   (d) (A) - (iii), (B) - (iv), (C) - (i), (D) - (ii)

16. A gas undergoes physical adsorption on a surface and follows the given Freundlich adsorption isotherm equation $\frac{x}{m} = Kp^{0.5}$.
   Adsorption of the gas increases with
   (a) increase in p and increase in T
   (b) increase in p and decrease in T
   (c) decrease in p and decrease in T
   (d) decrease in p and increase in T

17. The correct option among the following is
   (a) colloidal medicines are more effective, because they have small surface area.
   (b) brownian motion in colloidal solution is faster if the viscosity of the solution is very high.
   (c) addition of alum to water makes it unfit for drinking.
   (d) colloidal particles in lyophobic sols can be precipitated by electrophoresis.

18. Peptisation is a
    (a) process of bringing colloidal molecule into solution
    (b) process of converting precipitate into colloidal solution
    (c) process of converting a colloidal solution into precipitate
    (d) process of converting soluble particles to form colloidal solution
19. Among the following, the incorrect statement about colloids is
    (a) They can scatter light
    (b) They are larger than small molecules and have high molar mass
    (c) The osmotic pressure of a colloidal solution is of higher order than the true solution at the same concentration
    (d) The range of diameters of colloidal particles is between 1 and 1000 nm
20. Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, x is the mass of the gas adsorbed on mass m of the adsorbent at pressure p. (x/m) is proportional to



    (a) p^2 (b) $p^{1/4}$
    (c) $p^{1/2}$ (d) p
21. Which of the salt-solution is most effective for coagulation of arsenious sulphide?
    (a) $BaCl_2$ (b) $AlCl_3$
    (c) Na_3PO_4 (d) NaCl
22. The correct match between item-I and Item-II is

Item - I	**Item - II**
A. Benzaldehyde	P. Dynamic phase
B. Alumina	Q. Adsorbent
C. Acetonitrile	R. Adsorbate

    (a) (A) → (R); (B) → (Q); (C) → (P)
    (b) (A) → (P); (B) → (R); (C) → (Q)
    (c) (A) → (Q); (B) → (P); (C) → (R)
    (d) (A) → (Q); (B) → (R); (C) → (P)
23. Which of the following is not an example of heterogeneous catalytic reaction?
    (a) Harber's process
    (b) Combustion of coal
    (c) Hydrogenation of vegetable oils
    (d) Ostwald's process
24. Haemoglobin and gold sol are examples of
    (a) negatively and positively charged sols, respectively
    (b) Negatively charged sols
    (c) positively charged sols
    (d) positively and negatively charged sols, respectively
25. Among the following reactions of hydrogen with halogens, the one that requires a catalyst is
    (a) $H_2 + Cl_2 \longrightarrow 2HCl$ (b) $H_2 + I_2 \longrightarrow 2HI$
    (c) $H_2 + F_2 \longrightarrow 2HF$ (d) $H_2 + Br_2 \longrightarrow 2HBr$
26. An example of solid sol is
    (a) gem stones (b) half cream
    (c) butter (d) paint
27. Among the colloids cheese (C), milk (M) and smoke (S), the correct combination of the dispersed phase and dispersion medium, respectively is
    (a) C : liquid in solid; M : liquid in liquid; S : solid in gas
    (b) C : solid in liquid; M : liquid in liquid; S : gas in solid
    (c) C : liquid in solid; M : liquid in solid; S : solid in gas
    (d) C : solid in liquid; M : solid in liquid; S : solid in gas
28. Given Gas : H_2, CH_4, CO_2, SO_2
    Critical temperature/K 33 190 304 630
    On the basis of data given above, predict which of the following gases shows least adsorption on a definite amount of charcoal?
    (a) CH_4 (b) SO_2
    (c) CO_2 (d) H_2
29. They Tyndall effect is observed only when following conditions are satisfied
    I. The diameter of the dispersed particles is much smaller than the wavelength of the light used.
    II. The diameter of the dispersed particle is not much smaller than the wavelength of the light used.
    III. The refractive indices or the dispersed phase and dispersion medium are almost similar in magnitude.
    IV. The refractive indices of the dispersed phase and dispersion medium differ greatly in magnitude.
    (a) I and IV (b) II and IV
    (c) I and III (d) II and III
30. For a linear plot of log (x/m) versus log p in a Freundlich adsorption isotherm, which of the following statements is correct? (k and n are constants)
    (a) $1/n$ appears as teh intercept
    (b) Only $1/n$ appears as the slope
    (c) $\log\left(\frac{1}{n}\right)$ appears as the intercept
    (d) Both k and $1/n$ appear in the slope term
31. Match the catalysts to the correct processes.

Catalyst	**Process**
(A) $TiCl_3$	(i) Wacker process
(B) $PdCl_2$	(ii) Ziegler-Natta polymerisation
(C) $CuCl_2$	(iii) Contact process
(D) V_2O_5	(iv) Deacon's process

    (a) (A) - (iii), (B) - (ii), (C) - (iv), (D) - (i)
    (b) (A) - (ii), (B) - (i), (C) - (iv), (D) - (iii)
    (c) (A) - (ii), (B) - (iii), (C) - (iv), (D) - (i)
    (d) (A) - (iii), (B) - (i), (C) - (ii), (D) - (iv)
32. The congulating power of electrolytes having ions Na^+,

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Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order

(a) $Al^{3+} < Ba^{2+} < Na^{+}$ (b) $Na^{+} < Ba^{2+} < Al^{3+}$

(c) $Ba^{2+} < Na^{2+} < Al^{3+}$ (d) $Al^{3+} < Na^{+} < Ba^{2+}$

33. According to Freundlich adsorption isotherm which of the following is correct?

(a) $\frac{x}{m} \propto p^0$ (b) $\frac{x}{m} \propto p^1$

(c) $\frac{x}{m} \propto p^{1/n}$

(d) All of the above are correct for different range of pressure

34. Which of the following statements is incorrect regarding physisorptions?
(a) It occurs because of van der Waals' forces
(b) More easily liquefiable gases are adsorbed readily
(c) Under high pressure, it results into multimolecular layer on adsorbent surface
(d) Enthalpy of adsorption ($\Delta H_{adsorption}$) is slow and positive

35. Gold numbers of protective colloids A, B C and D are 0.50, 0.01, 0.10 and 0.005 respectively. The correct order of their protective powers is
(a) D < A < C < B (b) C < B < D < A
(c) A < C < B < D (d) B < D < A < C

36. In Langumir's model of adsorption of a gas on a solid surface
(a) the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
(b) the adsorption at a single site on the surface may involve multiple molecules at the same time
(c) the mass of gas striking a given area of surface is proportional to the pressure of the gas
(d) the mass of gas striking a given area of surface is independent of the pressure of the gas

37. The disperse phase in colloidal iron (III) hydroxide and colloidal gold is positively and negatively charged, respectively. Which of the following statement is not correct?
(a) Coagulation in both sols can be brought about by electrophoresis
(b) Mixing the sols has no effect
(c) Sodium sulphate solution causes coagulation in both sols
(d) Magnesium chloride solution coagulates the gold so more readily than the iron (III) hydroxide sol.

38. The volume of a collidal particle, V_C as compared to the volume of a solute particle in a true solution V_S, could be

(a) $\frac{V_C}{V_S} = 10^3$ (b) $\frac{V_C}{V_S} = 10^{-3}$

(c) $\frac{V_C}{V_S} = 10^{23}$ (d) $\frac{V_C}{V_S} = 1$

39. Which one of the following characteristics is not correct for physical adsorption?
(a) Adsorption on solids is reversible
(b) Adsorption increases with increase in temperature
(c) Adsorption is spontaneous
(d) Both enthalpy and entropy of adsorption are negative

40. H_2 gas is adsorbed on the metal surface like tungsten. This follows..... order reaction.
(a) third (b) second
(c) zero (d) first

1. (a)	2. (a)	3. (c)	4. (d)	5. (a)
6. (d)	7. (d)	8. (a)	9. (b)	10. (c)
11. (a)	12 (c)	13. (a)	14. (d)	15. (c)
16. (b)	17. (d)	18. (b)	19. (c)	20. (c)
21. (b)	22. (a)	23. (b)	24. (d)	25. (b)
26. (a)	27. (a)	28. (d)	29. (b)	30. (b)
31. (b)	32. (b)	33. (d)	34. (d)	35. (c)
36. (c)	37. (b)	38. (a)	39. (b)	40. (c)

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