Q1: NTA Test 01 (Single Choice)

Four thousand active nuclei of a radioactive material are present at $t = 0$. After 60 minutes 500 active nuclei are left in the sample. The decay constant of the sample is

(A) $\frac{\ln(2)}{60}$ per minute

(B) $\frac{\ln(2)}{20}$ per minute

(C) $20 \ln(2)$ per minute

(D) $60 \ln(2)$ per minute

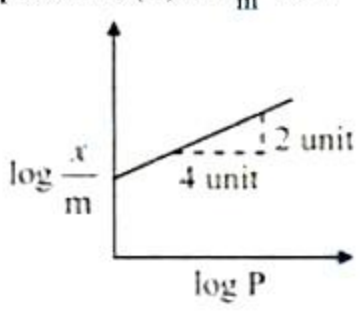
Q2: NTA Test 03 (Numerical)

The critical micelle concentration (CMC) of a cationic colloidal electrolyte is 10^{-3} M . If 1 mm^3 contains 10^{13} micelles, the number of cations making one micelle is

(Given, $N_A = 6.0 \times 10^{23}\ mol^{-1}$)

Q3: NTA Test 05 (Numerical)

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). if $\frac{x}{m} \propto P^{(1/y)}$ find the magnitude of 'y' is ——.



Q4: NTA Test 06 (Single Choice)

The gold numbers of a few protective colloids are

(A) Starch = 25

(B) Gelatin = 0.005 - 0.01

(C) Hemoglobin = 0.03

(D) Dextrin = 6 - 123.

Which is the best protective colloid ?

(A) A

(B) B

(C) C

(D) D

Q5: NTA Test 11 (Numerical)

For a first order reaction, the half-life is 10 mins. How much time in minutes will it take to reduce the concentration of reactant to 25% of its original concentration?

Q6: NTA Test 17 (Single Choice)

Which of the following sols is negatively charged?

(A) Ferric hydroxide

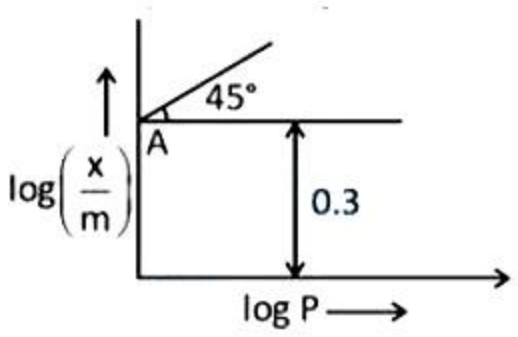
(B) Aluminium hydroxide

(C) Arsenious sulphide

(D) Silver iodide in silver nitrate solution

Q7: NTA Test 22 (Numerical)

Graph between $\log\left(\frac{x}{m}\right)$ vs $\log P$ is provided for adsorption of NH_3 gas on metal surface. Calculate weight of NH_3 gas (in gm) absorbed by 24 g of metal surface at 2 atm pressure. (Take $\log 2 = 0.3$)



Q8: NTA Test 24 (Single Choice)

Among the following, the surface that will form micelles in aqueous solution at the lowest molar concentration at ambient condition is:

(A) $CH_3\left(CH_2\right)_{15}N^+\left(CH_3\right)_3Br^-$

(B) $CH_3\left(CH_2\right)_{11}OSO_3^-\ Na^+$

(C) $CH_3\left(CH_2\right)_6COO^-Na^+$

(D) $CH_3\left(CH_2\right)_{11}N^+\left(CH_3\right)_3Br^-$

Q9: NTA Test 29 (Single Choice)

Which of the following statements is correct for a lyophilic sol?

(A) It is not easily solvated

(B) The coagulation of this sol is irreversible in nature

(C) It is unstable

(D) It is quite stable in a solvent

Q10: NTA Test 30 (Single Choice)

100 mL of 0.3 M acetic acid is shaken with 0.8 g wood charcoal. The final concentration of acetic acid in the solution after adsorption is 0.125 M. The mass of acetic acid adsorbed per gram of charcoal is

(A) 1.05 g

(B) 0.0131 g

(C) 1.31 g

(D) 0.131 g

Q11: NTA Test 30 (Single Choice)

Adsorption of gases on solid surface is generally exothermic because

(A) enthalpy is positive

(B) entropy decreases

(C) entropy increases

(D) free energy increases

Q12: NTA Test 31 (Single Choice)

For coagulation of Arsenious sulphide sol, which one of the following salt solution will be most effective

(A) $AlCl_3$

(B) NaCl

(C) $BaCl_2$

(D) Na_3PO_4

Q13: NTA Test 31 (Numerical)

During the nuclear explosion, one of the products is $_{90}Sr$ with half life of 6.93 years. If 1 μ g of $_{90}Sr$ was absorbed in the bones of a newly born baby in place of Ca, how much time (in years) is required to reduce it by 90%, if it is not lost metabolically?

Report your answer by rounding it up to a nearest whole number.

Q14: NTA Test 33 (Numerical)

5 ml of As_2S_3 is mixed with distilled waterand 0.01 M solution of an electrolyte AB so that total volume is 10 ml. it was found that all solution containing more than 5 ml of AB coagulate within 5 min. What is the Flocculation value of AB for As_2S_3 sol?

Q15: NTA Test 34 (Numerical)

Half-life period of the radioactive element A is 10 days. Amount of A left on the end of 11th day starting with 1 mole A is $\left(\frac{1}{2}\right)^{\frac{n+6}{10}}$ mole. What is the value of n.

Q16: NTA Test 38 (Single Choice)

The coagulation values in millimoles per litre of the electrolytes used for coagulation of As_2S_2 are given below.

I. $NaCl = 52$

II. $BaCl_2 = 0.69$

III. $MgSO_4 = 0.22$

The correct order of their coagulation is:

(A) III > I > II

(B) I > II > III

(C) II > I > III

(D) III > II > I

Q17: NTA Test 39 (Single Choice)

Which of the following statements about physical adsorption is not correct?

(A) It is usually monolayer

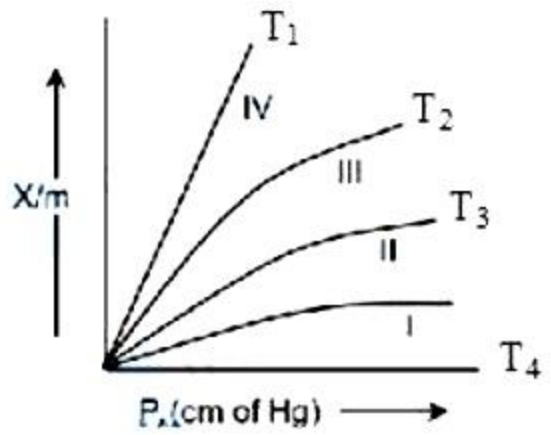
(B) It is reversible in nature

(C) It involves van der Waals interactions between adsorbent and adsorbate

(D) It involves small value of adsorption

Q18: NTA Test 43 (Single Choice)

The plots of the extent of adsorption (x/m) Vs pressure at different temperature are as follows;



The correct order of increasing temp for curves I, II, III, IV are ;

(A) $T_1 > T_2 > T_3 > T_4$

(B) $T_4 > T_3 > T_2 > T_1$

(C) $T_3 > T_2 > T_1 > T_4$

(D) can't be predicted

Q19: NTA Test 43 (Single Choice)

Which of the following is not an example of heterogeneous catalysis?

(A) $n\,(CH_2 = CH_2) \xrightarrow{R_3Al+TiCl_4} [-CH_2 - CH_2-]_4$

(B) $2SO_2 + O_2 \xrightarrow{Pt\text{-}Asbestos} 2SO_3$

(C) $RCOOR \xrightarrow[Catalyst]{H^+} RCOOH + ROH$

(D) $2H_2O_2\,(l) \xrightarrow{Hg(l)} 2H_2O + O_2$

Q20: NTA Test 44 (Numerical)

In the Freundlich adsorption isotherm, the value of $\left(\frac{1}{n}\right)$ is between 0 and ---.

Q21: NTA Test 48 (Single Choice)

10 mL of 1 mM surfactant solution forms a monolayer covering 0. 24 cm^2 on a polar substrate. If the polar head is approximated as cube, what is its edge length?

(A) 2.0 pm

(B) 2.0 nm

(C) 1.0 pm

(D) 0.1 nm

Answer Keys

Q1: (B) | **Q2:** 60.00 | **Q3:** 2

Q4: (B) | **Q5:** 20 | **Q6:** (C)

Q7: 9 | **Q8:** (A) | **Q9:** (D)

Q10: (C) | **Q11:** (B) | **Q12:** (A)

Q13: 23 | **Q14:** 5 | **Q15:** 5

Q16: (D) | **Q17:** (A) | **Q18:** (B)

Q19: (C) | **Q20:** 1 | **Q21:** (A)

Solutions

Q1: (B) $\frac{\ln(2)}{20}$ per minute

60 minutes = 3 half lives

$\therefore T_{\frac{1}{2}} = 20 \text{ min}$

$\therefore \lambda = \frac{\ln 2}{t_{1/2}} = \frac{\ln 2}{20} \text{per min}$

Q2: 60.00

At CMC, the number of cationic colloidal particles $= 10^{-3} \times 6.0 \times 10^{23} = 6.0 \times 10^{20}$ per L

Therefore, number of particles per mm^3

$= \frac{6.0 \times 10^{20}}{10^6} \left(\because 1L = 10^6 mm^3\right)$

$= 6.0 \times 10^{14}$ particles/ mm^3

Number of micelles in 1 $mm^3 = 10^{13}$ (given)

Number of cations forming one micelle

$= \frac{6.0 \times 10^{14}}{10^{13}}$

$= 60$ cations

Q3: 2

According to Freundlich adsorption isotherm,

$\frac{x}{m} = K \times P^{1/n}$

$\log \frac{x}{m} = \log K + \frac{1}{n} \log P$

$m = \frac{1}{n} = \frac{2}{4} = \frac{1}{2} \Rightarrow n = 2$

So, $\frac{x}{m} = K \times P^{1/2}$

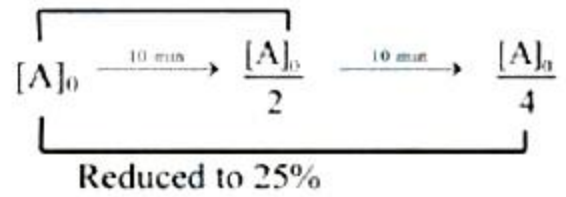
Therefore, value of 'y' is 2.

Q4: (B) B

Smaller the gold number, greater will be its protecting power.

Q5: 20

It takes two half-lives to reduce the concentration of reactant to 25% of its original concentration.

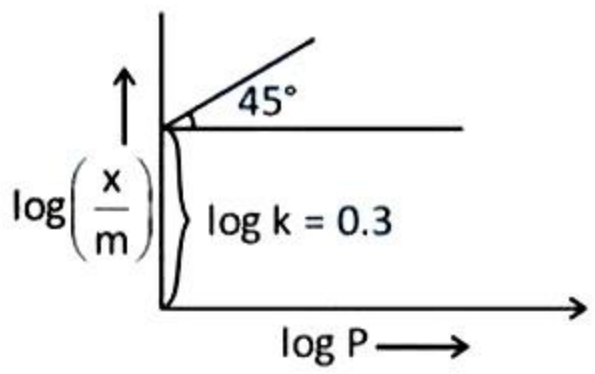


Hence, total time taken $= 10 + 10$
$= 20$ minutes.

Q6: (C) Arsenious sulphide

Ferric hydroxide = Positive sol
Aluminium hydroxide = Positive sol
Arsenious sulphide = Negative sol

Q7: 9



$\text{Slope} = \frac{1}{n} = \tan 45^{o} = 1$
$\frac{x}{m} = KP^{\frac{1}{n}}$
$\log\left(\frac{x}{m}\right) = \log K + \frac{1}{n}\log P$
$= \log 2 + \frac{1}{n}\log 2$
$\log\left(\frac{x}{m}\right) = \log 2 + (1)\log(2)$
$\frac{x}{m} = 2 \times 2$
$\frac{x}{24} = 4$
$x = 4 \times 24 = 96$ g

Q8: (A) $CH_3\left(CH_2\right)_{15}N^{+}\left(CH_3\right)_3Br^{-}$

Larger the hydrophobic fragment of surfactant molecule easier will be micellisation, smaller the CMC value i.e. $CH_3\left(CH_2\right)_{15}N^{+}\left(CH_3\right)_3Br^{-}$ will have lowest CMC due to longest hydrophobic chain.

Q9: (D) It is quite stable in a solvent

In lyophilic sols, the dispersed phase particles have great affinity for the dispersion medium. These sols are reversible. These are quite stable. Examples include gum, gelatin, starch, proteins and rubber etc.

Q10: (C) 1.31 g

$\text{Mass adsorbed} = \frac{100(0.3-0.125)60}{1000} = 1.05$ g
$\text{Mass adsorbed per gram of charcoal} = \frac{(0.3-0.125)6}{0.8} = 1.3125$

Q11: (B) entropy decreases

Thermodynamics of adsorption:

$$\underbrace{A(g)}_{\text{Gas}} + \underbrace{M(s)}_{\text{Metal Surface}} \longrightarrow MA(s) \qquad \Delta S < 0$$

i. $\Delta S < 0$ because gaseous phase decrease

ii. $\Delta G < 0$ because process is spontaneous

so $\Delta G = \Delta H - T\Delta S$

$-ve = \Delta H - (+ve)\,(-ve)$

$\Delta H = -ve$

iii. $\Delta H < 0$ so adsorption is an exothermic process.

Q12: (A) $AlCl_3$

Arsenious sulphide is -ve charged colloid. Hence, cation having maximum positive charge will be most effective for coagulation. (Hardy Schulz rule)

$Al^{3+} > Ba^{2+} > Na^{+}$ (coagulating power)

Q13: 23

$\frac{t_{90\%}}{t_{50\%}} = \frac{\ln \frac{100}{10}}{\ln 2}$

$t_{90\%} = \frac{\ln_{10}}{\ln_2} \times t_{50\%} = \frac{6.93 \times \ln 10}{0.693} = 23.03$ years

Q14: 5

A minimum of 5 ml of AB is required to coagulate the sol, the moles of AB in sol is $= \frac{5 \times 0.01}{10} = 0.005$ moles this means that a minimum of 0.005 moles or $0.005 \times 1000 = 5$ milli moles are required for coagulation 1 litre of sol. flocculation value of AB for As_2S_3 sol = 5

Q15: 5

$A_t = A_0 \times \left(\frac{1}{2}\right)^{\text{no of half life}}$

$\left(\frac{1}{2}\right)^{\left(\frac{n+6}{10}\right)} = \left(\frac{1}{2}\right)^{\left(\frac{11}{10}\right)}$

$n = 5$

Q16: (D) III > II > I

Coagulation value $\propto \frac{1}{\text{coagulating power}}$

$\therefore$ Coagulating power As_2S_3 is

$MgSO_4 > BaCl_2 > NaCl$

III > II > I

Q17: (A) It is usually monolayer

Physical adsorption is a multilayer phenomenon. Rest all are correct features of physical adsorption.

Q18: (B) $T_4 > T_3 > T_2 > T_1$

Physisorption is exothermic in nature. Therefore, in accordance with Le-Chatliers principle, it decreases with increase in temperature. This means physisorption occurs at low temperature more readily. So, The correct order of temperature for curves I, II, III, IV are :

$T_4 > T_3 > T_2 > T_1$

Q19: (C) $\mathrm{RCOOR} \xrightarrow[\text{Catalyst}]{H^+} \mathrm{RCOOH} + \mathrm{ROH}$

It is an example of homogeneous solution phase catalysis in which catalyst and reactant in solution phase of miscible nature whereas in d, reactant is liquid and catalyst is also liquid but are immiscible and have more than one phase.

Q20: 1

$\frac{x}{M} = KP^{\frac{1}{n}}$

$\Rightarrow 0 \leq \frac{1}{n} < 1$

Q21: (A) 2.0 pm

$\text{Millimoles} = 10 \times 10^{-3} = 10^{-2}$

$\text{Moles} = 10^{-5}$

$\text{No. of molecules} = 6 \times 10^{23} \times 10^{-5} = 6 \times 10^{18}$

Surface area ocupied by one molecule

$= \frac{0.24}{6 \times 10^{18}} = 0.04 \times 10^{-18} \text{cm}^2$

$4 \times 10^{-20} = x^2 \left[\because x = \text{edge length}\right]$

$x = 2 \times 10^{-10}\ \text{cm} = 2\ \text{pm}$