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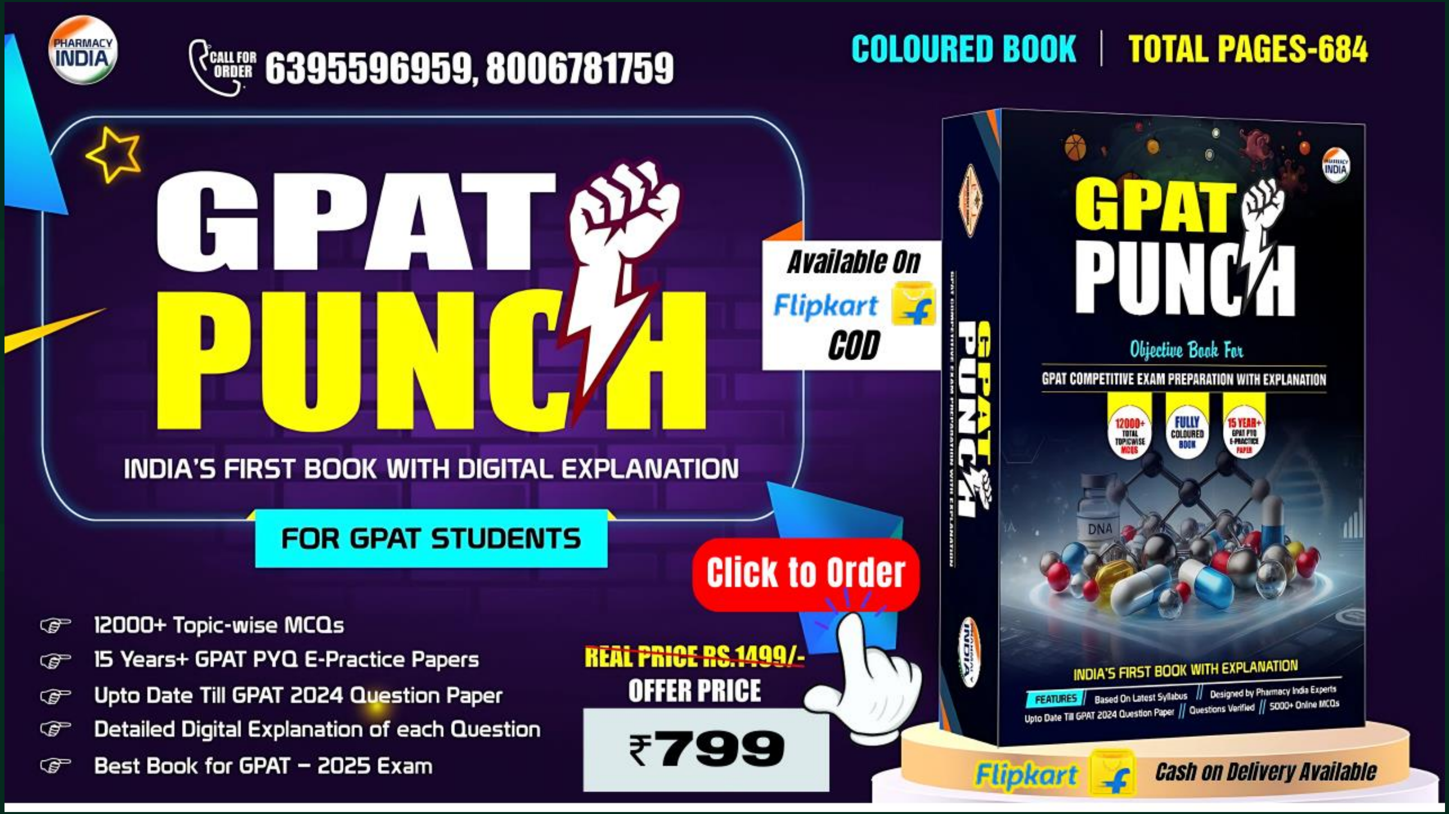

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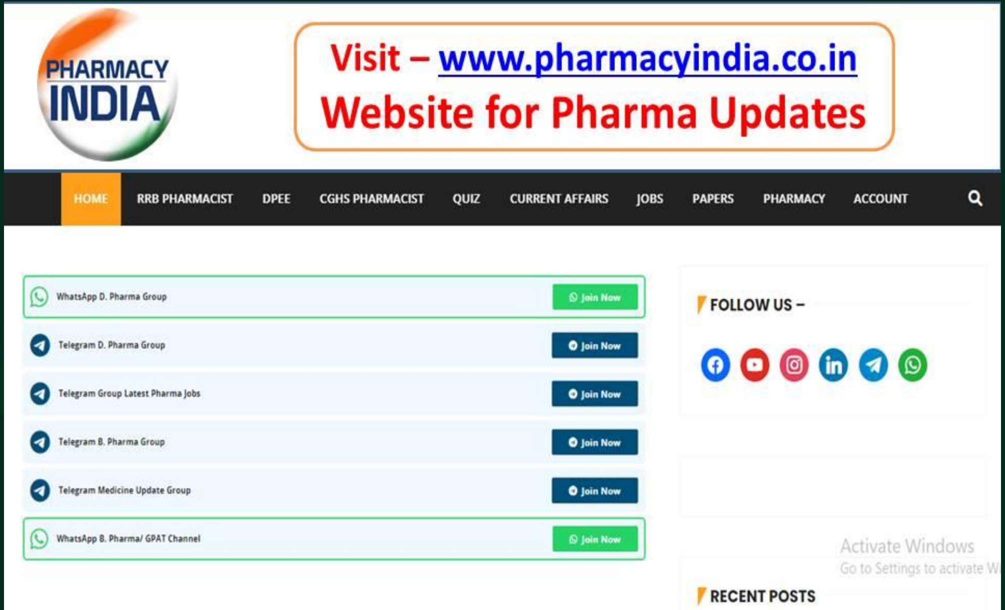

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1. The interfacial forces are related to the contact angle by [GPAT-2023 SHIFT-I]

(a) Nernst Equation

(b) Stoke's Equation

(c) Young's Equation

(d) Laplace Equation

1. **The interfacial forces are related to the contact angle by [GPAT-2023 SHIFT-I]**

(a) Nernst Equation

(b) Stoke's Equation

(c) Young's Equation

(d) Laplace Equation

Explanation:

- Young’s equation is expressed as:

$$\mathrm{Cos}\ \theta = \frac{\gamma SG - \gamma SL}{\gamma LG}$$

Where:

- θ: Contact angle.
- ϒSG: Surface tension between solid and gas.
- ϒSL: Surface tension between solid and liquid.
- ϒLG: Surface tension between liquid and gas.

- This equation explains how the wettability of a surface (contact angle) is determined by interfacial forces.

2. **In the Langmuir Isotherm, following statements are true EXCEPT one [GPAT-2023 SHIFT-I]**

(a) The layer of the gas adsorbed on the solid adsorbent is one molecule thick

(b) Adsorbed layer is uniform all over adsorbent

(c) No desorption takes place when gas strikes solid surface

(d) No interaction between the adjacent adsorbed molecules takes place

2. In the Langmuir Isotherm, following statements are true EXCEPT one [GPAT-2023 SHIFT-I]

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(c) No desorption takes place when gas strikes solid surface

(d) No interaction between the adjacent adsorbed molecules takes place

Explanation:

- **The Langmuir isotherm assumes:**
  - Adsorption occurs on specific homogeneous sites on the surface.
  - Each adsorption site can hold only one molecule (monolayer).
  - No interaction occurs between adsorbed molecules.
  - Desorption and adsorption reach equilibrium.

3. Which of the following surfactants is an ANIONIC surfactant [GPAT-2023 SHIFT-I]

(a) Lecithin

(b) Sorbitan esters

(c) Benzalkonium chloride

(d) Soaps

3.

Which of the following surfactants is an ANIONIC surfactant [GPAT-2023 SHIFT-I]

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(d) Soaps

Explanation:

- Anionic surfactants dissociate in water to form negatively charged surfactant ions. Examples include soaps (e.g., sodium lauryl sulfate and sodium stearate).
- Their charge allows them to interact with positively charged surfaces, making them effective in cleaning and emulsification.

4. **Which of the following emulsifiers has the highest HLB value [GPAT-2023 SHIFT-I]**

(a) Span 80

(b) Acacia

(c) Tween 80

(d) Sodium lauryl sulfate

4. Which of the following emulsifiers has the highest HLB value [GPAT-2023 SHIFT-I]

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(b) Acacia

(c) Tween 80

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Explanation:

HLB values of some common surface active agents

Surface active agents	HLB value
Oleic acid	1
Polyoxyethylene sorbitol beeswax derivative (G-1706)	2
Sorbitan tristearate	2.1
Glyceryl monostearate	3.8
Sorbitan monooleate (Span 80)	4.3
Diethylene glycol monostearate	4.7
Sorbitan monolaurate (Span 20)	8.6
Polyethylene lauryl ether (Brij 30)	9.5

Surface active agents	HLB value
Polyoxyethylene monostearate (Myrj 45)	11.1
Triethanolamine oleate	12
Polyoxyethylene sorbitan monooleate (Tween 80)	15
Polyoxyethylene sorbitan monolaurate (Tween 20)	16.7
Polyoxyethylene lauryl ether (Brij 35)	16.9
Sodium oleate	18
Potassium oleate	20
Sodium lauryl sulfate	40

5. The addition of Monobasic Potassium Phosphate to the suspended Bismuth Subnitrate particles cause the A to B owing to the C [GPAT-2023 SHIFT-II]

(a) A-negative zeta potential, B-decrease, C-adsorption of the negatively charged phosphate anion

(b) A-positive zeta potential, B-increase, C-adsorption of the negatively charged phosphate anion

(c) A-positive zeta potential, B-decrease, C-adsorption of the negatively charged phosphate anion

(d) A-positive zeta potential, B-decrease, C-adsorption of the positively charged hydrogen anion

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(c) A-positive zeta potential, B-decrease, C-adsorption of the negatively charged phosphate anion

(d) A-positive zeta potential, B-decrease, C-adsorption of the positively charged hydrogen anion

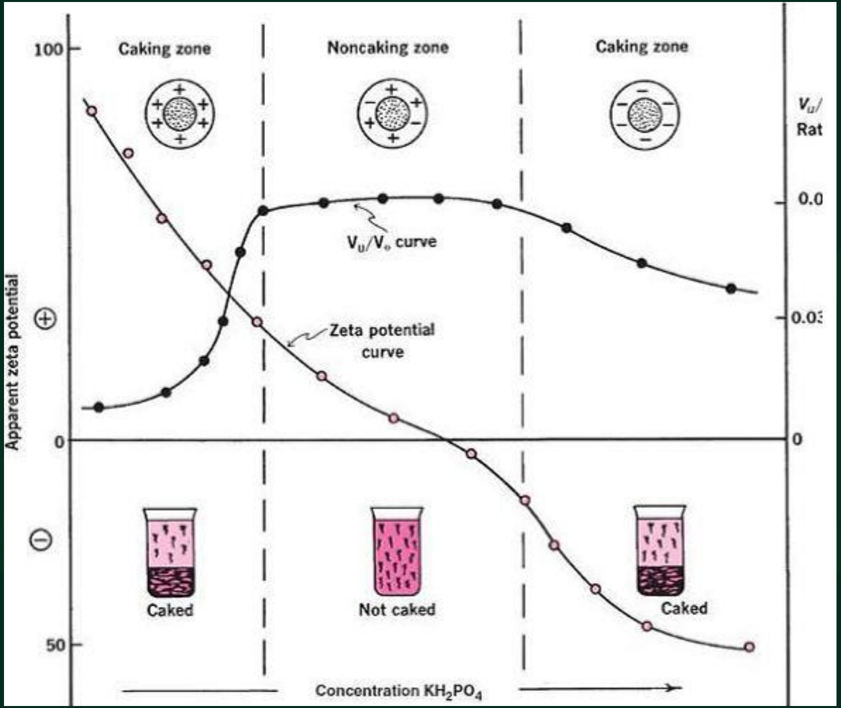
Explanation:

Electrolytes: The effect of electrolytes on the flocculation of a suspension is depicted with a suitable example.

- When bismuth subnitrate is dispersed in water, the bismuth particles assume a large positive charge or zeta potential (25 mV or above). The like charges on the surface experience repulsive forces and the system becomes deflocculated. These particles resist collisions even if they are brought together by agitation.

- When a flocculating agent, monobasic potassium phosphate, is added to the above suspension in small quantities, the negatively charged phosphate ions get adsorbed on the positively charged bismuth particles. The forces of repulsions decrease and the attractive forces begin to operate.
- As a result, the positive zeta potential decreases and the solids begin to form flocs (Figure 5-8). This is evident from the maximum sedimentation volume. On further addition of electrolytes, the zeta potential decreases gradually and becomes zero. During this stage too, suspended particles remain as flocs.

- Zero zeta potential indicates that the repulsive forces are nil. At this stage, the attractive forces start operating. This condition is required for the formation of flocs. In practice, it is observed that the sedimentation volume (F) becomes the maximum, at zero zeta potential.



6. The properties of solutions containing surface active agents change sharply over a narrow concentration range and are called as [GPAT-2021]

(a) Critical micelle concentration

(b) Ionic concentration

(c) Hydrogen ion concentration

(d) Surface tension

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(a) Critical micelle concentration

(b) Ionic concentration

(c) Hydrogen ion concentration

(d) Surface tension

Explanation:

- Critical micelle concentration, CMC, is defined as the concentration range of a surfactant at which micelles start forming.
- CMC is a concentration range and has the unit of concentration such as w/w, w/v per cent, moles/liter and moles/1000 g of solvent.

The phenomenon of micelle formation is as follows:

- Below CMC, surface active agents preferentially get adsorbed at air-water interface. As the concentration of surfactant increases, molecules get accumulated progressively at the interface.

- In this process, at one particular concentration, the interface gets saturated, while the bulk phase is saturated with monomers. The formation of micelles is so spontaneous that it is difficult to differentiate the concentrations related to saturated phase and micelle phase. In the bulk of the solution, both monomers and micelles are in dynamic equilibrium. This concentration is called as CMC. Beyond CMC, any further addition of surface-active agents enhances the formation of micelles only.

- This process is spontaneous, i.e. the free energy of the system is reduced. Preparation of association colloids is easy for this reason. Adhesive forces are well balanced, which is possible only in the bulk of the solution. Hence, micelles remain in the bulk of the solution, i.e. not surface active.

7.

Which statements are correct for the micelle formation [GPAT-2018]

[P] Micelles are dynamic structures that are continually formed and broken down in solution

[Q] The typical micelle diameter is about 2-3 μm and so they are visible under the light microscope

[R] Micelle formation is a spontaneous process

[S] When the surfactant concentration is increased above the CMC, the number of micelles increases and the free surfactant concentration decreases below CMC

(a) [P] and [Q]

(b) [P] and [R]

(c) [P] and [S]

(d) [R] and [S]

7. Which statements are correct for the micelle formation [GPAT-2018]

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[S] When the surfactant concentration is increased above the CMC, the number of micelles increases and the free surfactant concentration decreases below CMC

(a) [P] and [Q]
(b) [P] and [R]
(c) [P] and [S]
(d) [R] and [S]

Explanation:

- A micelle is an electrically charged particle formed by an aggregate of molecules, above a critical concentration and occurring in certain colloidal electrolyte solutions.
- In other words, molecular aggregates that form above the CMC area are known as micelles.
- CMC is the lowest concentration at which micelles first appear is called critical concentration for micelle formation
- The CMC is the concentration above surfactant when micelles will form spontaneously

- Increase in concentration of surfactant beyond CMC change number size or shape but not provide increase in concentration of monomeric species
- Micelles are dynamic structures that are continually formed and broken down in solution
- The typical micelle diameter is about 2-3 nm and so they are not visible under the light microscope.

8. The interfacial tension of Oleic acid against water at 20°C is [GPAT-2018]

(a) 15.6

(b) 52.3

(c) 428

(d) 8.51

8. The interfacial tension of Oleic acid against water at 20°C is [GPAT-2018]

(a) 15.6

(b) 52.3

(c) 428

(d) 8.51

Explanation:

- Interfacial tension between oleic acid and water is experimentally measured and falls within the range of 15.6 dynes/cm. This value is influenced by the molecular interactions at the interface.

9. Which of the following is an example of hemiesters anionic surfactant for pharmaceutical emulsions [GPAT-2017]

(a) Sulfosuccinates

(b) Sarcosinates

(c) Taurates

(d) Lactylates

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Explanation:

TYPE CLASSIFICATION OF SURFACTANTS USED IN PHARMACEUTICAL EMULSION WITH EXAMPLES ARE GIVEN BELOW

SURFACTANT	EXAMPLES
Anionic surfactant	
Soaps	Sodium oleate
	Sodium palmitate
Sulphates	Sodium lauryl sulphate
Ether sulphates	Sodium laureth Sulphate
Benzene sulphonate	4-benzyl dodecane, Sulphonate Sodium
Hemiesters	Sodium dioctyl
	Sulphosuccinate
Sarcoides	Lauryl sarcosinate

SURFACTANT	EXAMPLES
Anionic surfactant	
Miscellaneous	Cetrimide Cetylpyridinium chloride
Cationic surfactant	
Amines	Tetradecyl methyl amine, Cetyl trimethyl Ammonium bromide
Quartenary ammoniums	Benzalkonium chloride
	Hexadecyl trimethyl
	Ammonium chloride

SURFACTANT	EXAMPLES
Non-ionic surfactant	
Ethoxylated alcohols	Tridecanol
Etoxylated amides	Di acyl ethoxy urea
Fatty acid esters	Sorbitan monosterate
	Polyoxyethylene sorbitan monolaurate, Polyoxyethylene sorbitan mono-oleate
	Glycerol trimer
Ampholytic surfactants	
Ammonium phosphate	Lecithin
Amino propionic	
Quartenary compounds	Betain, Sulfobetain

10. Surface tension is categorized as a/an factor [GPAT-2017]

(a) Capacity

(b) Intensive

(c) Extensive

(d) Tolerance

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(a) Capacity

(b) Intensive

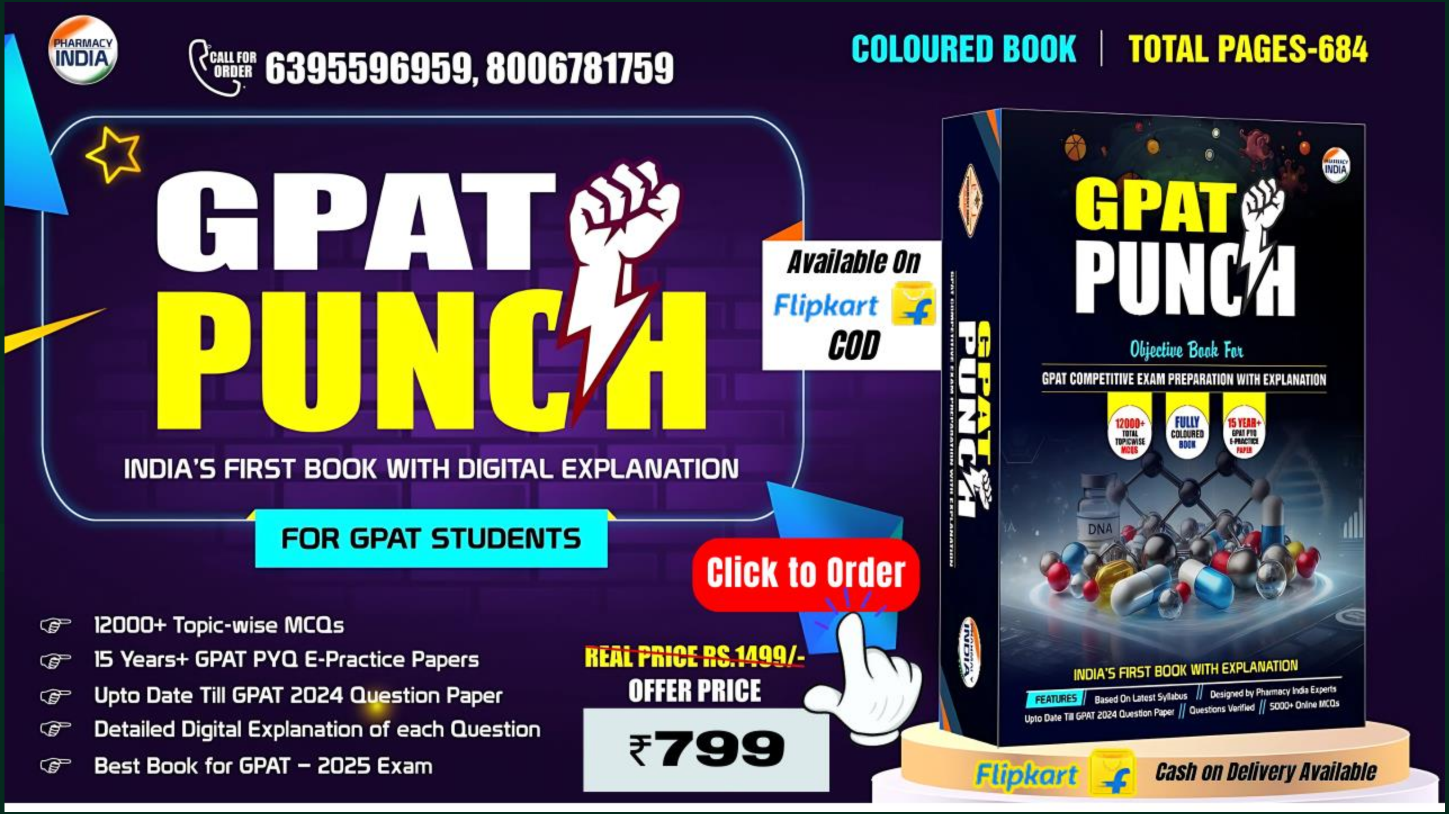
(c) Extensive

(d) Tolerance

Explanation:

INTENSIVE AND EXTENSIVE PROPERTIES

INTENSIVE PROPERTIES	EXTENSIVE PROPERTIES
A property which does not depend on the quantity of matter present in the system, is known as Intensive Property.	A property that does depend on the quantity of matter present in the system, is called an Extensive Property.
Some examples of intensive properties are pressure, temperature, density, surface tension and concentration	Some examples of extensive properties are volume, number of moles, enthalpy, entropy, and Gibbs' free energy.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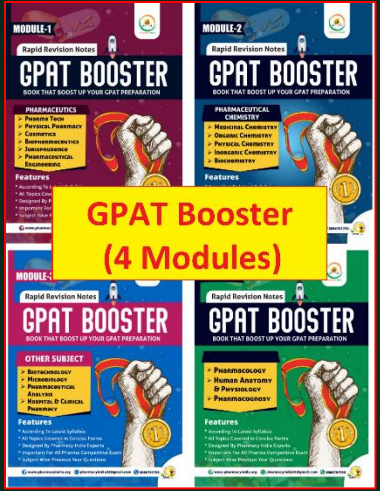

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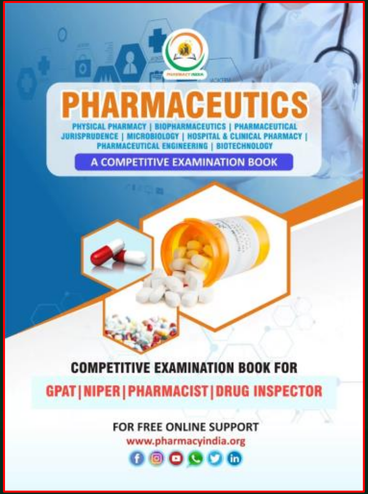

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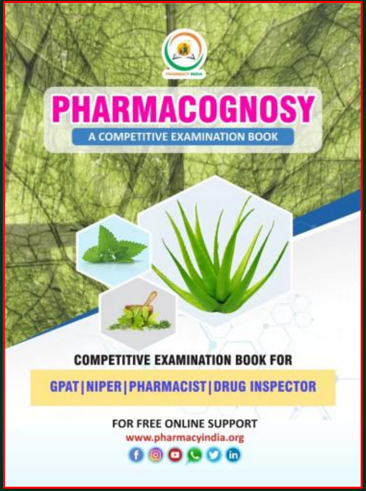

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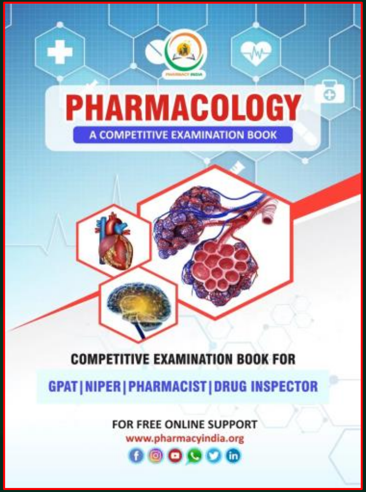

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11. Which among the following statements describing surface activity for surfactants is incorrect [GPAT-2017]

(a) Increase in length of hydrocarbon chain decreases surface activity

(b) Increase in ethylene oxide chain of polyoxy ethylated nonionic surfactant ethylene decrease of surface activity

(c) Increase in the surface activity results in decrease in surface tension

(d) Relationship between hydrocarbon chain length and surface activity is expressed by Traube's rule

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(c) Increase in the surface activity results in decrease in surface tension

(d) Relationship between hydrocarbon chain length and surface activity is expressed by Traube's rule

Explanation:

- The surface activity of a particular surfactant depends on the balance between its hydrophilic and hydrophobic properties. For a homologous series of surfactants:
- An increase in the length of the hydrocarbon chain (hydrophobic) increases the surface activity. This relationship between hydrocarbon chain length and surface activity is expressed by Traube's rule, which states that in dilute aqueous solutions of surfactants belonging to any one homologous series, the molar concentrations required to produce equal lowering of the surface tension of water decreases threefold for each additional CH_2 group in the hydrocarbon chain of the solute.

- Surfactant are characterised by the presence of water solublizing and fat solublizing group in the same molecule
- An increase of the length of the ethylene oxide chain (hydrophilic) of a polyoxyethylated non-ionic surfactant results in a decrease of surface activity.

12. Micelles are observed in water, when the added surfactant is within a particular concentration range. This concentration range should be [GPAT-2016]

(a) Equal to and less than CMC

(b) Equal to and more than CMC

(c) Equal to CMC

(d) More than CMC

12. Micelles are observed in water, when the added surfactant is within a particular concentration range. This concentration range should be [GPAT-2016]

(a) Equal to and less than CMC

(b) Equal to and more than CMC

(c) Equal to CMC

(d) More than CMC

Explanation:

- Critical micelle concentration (CMC) is defined as the concentration of surfactants above which micelles are spontaneously formed.
- A micelle is an aggregate of surfactant molecules dispersed in a liquid colloid.
- A typical micelle in aqueous solution forms an aggregate with the hydrophilic “head” regions in contact with surrounding solvent, sequestering the hydrophobic single tail regions in the micelle center.

- As the concentration of the surface-active agent go on increasing then at particular concentration these surface agents are no more orient at the interface and no further reduction in surface/interface tension because now the surface-active agents will go in bulk of liquid and these surface active agents will self-associate to form colloidal sized aggregates called as micelles which dominates above Critical Micelle Concentration or threshold concentration.

13. HLB value of tragacanth is [GPAT-2018]

(a) 4.7

(b) 8.7

(c) 13.2

(d) 14.3

13. HLB value of tragacanth is [GPAT-2018]

(a) 4.7

(b) 8.7

(c) 13.2

(d) 14.3

Explanation:

The HLB value of Tragacanth is generally considered to be 13.2. This indicates that Tragacanth is primarily hydrophilic (water-soluble) and can be used as an emulsifier in oil-in-water emulsions.

14. **HLB of SPAN and TWEEN surfactants may be obtained from which of the following equations [GPAT-2016]**

(a) HLB = E/5

(b) HLB = (E+P)/5

(c) HLB = 20 [(1-S)/A)]

(d) HLB = (hydrophilic group numbers)- (lipophilic group numbers) +7

14. HLB of SPAN and TWEEN surfactants may be obtained from which of the following equations [GPAT-2016]

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(c) HLB = 20 [(1-S)/A)]

(d) HLB = (hydrophilic group numbers)- (lipophilic group numbers) +7

Explanation:

$$HLB = \Sigma \text{ hydrophilic group no} - \Sigma \text{ lipophilic group no.} + 7$$

E.g. Sodium lauryl sulphate

For waxes:

$$HLB = (E+P)/5$$

Where: E→ percentage by weight of ethylene oxide chains

P→ percentage by weight of polyhydric alcohol groups

E.g. Beeswax, Lanolin

For esters:

$$HLB = 20\,(1 - S/A)$$

Where: S is the saponification number of ester

A is the acid number of corresponding hydrolysed acid

E.g. Glyceryl monostearate

For polyxyethylene based non-jonic surfactant:

$$HLB = \text{mol\% of hydrophilic groups}/5$$

E.g. Tweens

15. The definition of a surfactant (an ingredient in toothpaste) can best be described by which of the following statement [GPAT-2016]

(a) Prevent drying of the preparation

(b) Removes debris by it's detergent action and causes foaming, which is usually desired by the patient

(c) Determines the texture, dispersiveness and appearance of the product

(d) Adds flavor to the preparation which makes it more appealing to the patient

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(d) Adds flavor to the preparation which makes it more appealing to the patient

Explanation:

- The surfactant used in dental preparation is called as wetting agent. The mechanism involves cleaning action by reducing the surface area at the interface of the adhered material and enamel of the teeth. By detergent action, it causes foaming, and removes debris which is usually desired by the patient.
- They aid in abrasive action by wetting the surface of the teeth. They help in the diffusion of paste into narrow spaces, thus enhancing the cleaning action. Most commonly used surfactant in toothpaste: Sodium Lauryl sulphate, Sodium Lauryl Sarcosinate

16. Measuring zeta potential is useful in determining which property of a liquid formulation [GPAT-2016]

(a) Viscosity

(b) Stability

(c) Solubility

(d) Particle size

16. Measuring zeta potential is useful in determining which property of a liquid formulation [GPAT-2016]

(a) Viscosity

(b) Stability

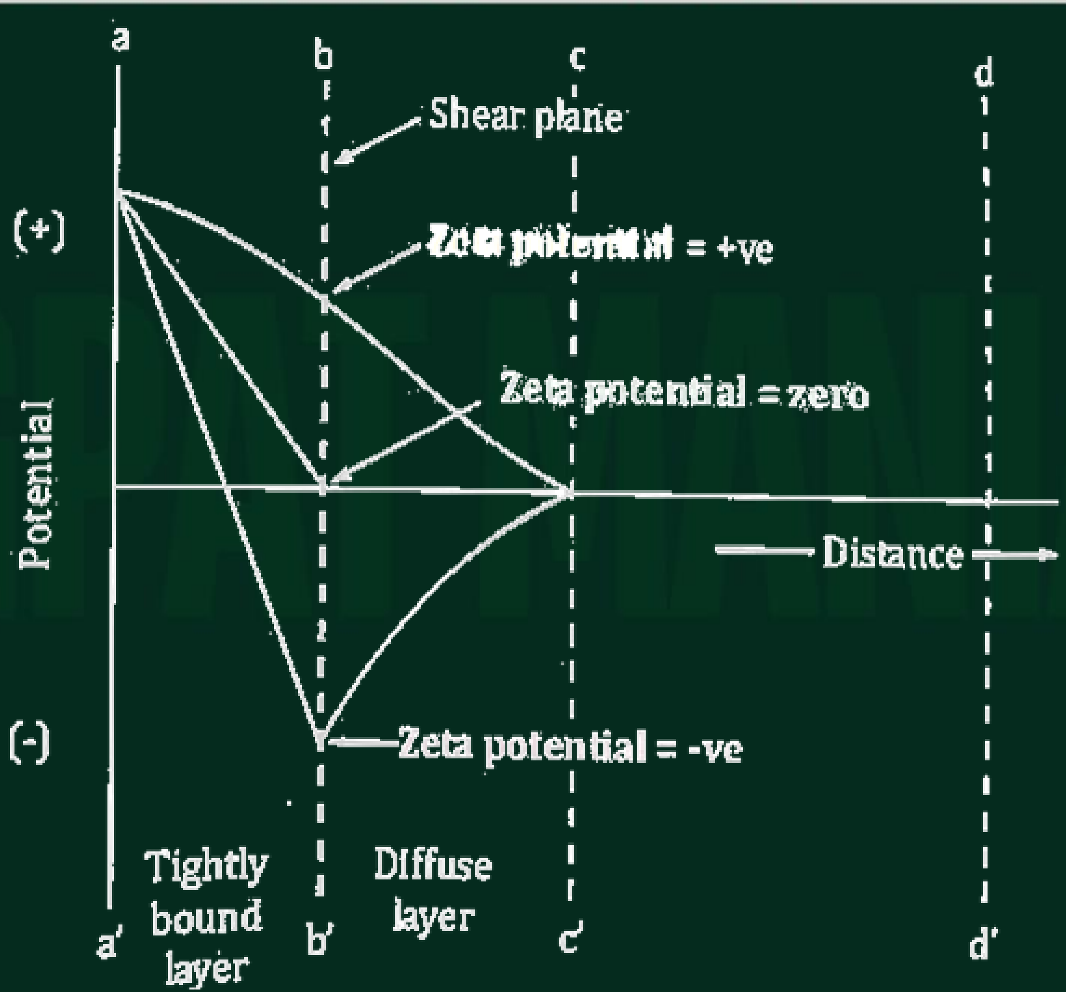
(c) Solubility

(d) Particle size

Explanation:

ZETA POTENTIAL

- The electric potential at the boundary of the double layer is known as the Zeta potential of the particles and has values that typically range from +100 mV to-100 mV.
- Zeta potential is used to determine the stability of disperse phase, and degree of repulsion between adjacent, and zeta potential is potential difference between shear plane & the electrical neutral region.
- Zeta potential governs the degree of repulsion between adjacent, similarly charged solid dispersed particles.


a
b
c
d
Shear plane
(+)
Zeta potential = +ve
Zeta potential = zero
Potential
Distance
(-)
Zeta potential = -ve
Tightly bound layer
Diffuse layer
a′
b′
c′
d′

17. For the wetting of a solid by liquids, the contact angle (in degree) should have a value nearly [GPAT-2016]

(a) 0

(b) 90

(c) 180

(d) 270

17. For the wetting of a solid by liquids, the contact angle (in degree) should have a value nearly [GPAT-2016]

(a) 0

(b) 90

(c) 180

(d) 270

Explanation:

ANGLE OF CONTACT

- A contact angle equal to 0°, partial wetting takes place. In other words, adhesive forces between Solid Liquid interface is equal that the cohesive forces between Liquid Liquid interface
- Angle between liquid droplet and surface over which it spreads is called contact angle.

CONTACT ANGLE (COS θ)	DEGREE OF WETTING
$\theta = 0$	Perfect wetting
$0 < \theta < 90°$	High wettability
$90° \leq \theta < 180°$	Low wettability
$\theta = 180°$	Perfectly non-wetting

CONTACT ANGLE	CONDITIONS
$\theta = 180°$	Non-wetting
$\theta > 90°$	Cohesive force > Adhesive force
$\theta = 90°$	Cohesive force = Adhesive force
$\theta < 180°$	Adhesive force > Cohesive force
$\theta = 0°$	Complete wetting

18. What is the surface tension of water of at 25°C [GPAT-2016]

(a) 58 dyne/cm

(b) 68 dyne/cm

(c) 72 dyne/cm

(d) 82 dyne/cm

18. What is the surface tension of water of at 25°C [GPAT-2016]

(a) 58 dyne/cm

(b) 68 dyne/cm

(c) 72 dyne/cm

(d) 82 dyne/cm

Explanation:

Surface tension is the energy required to increase the surface area of a liquid. Water's surface tension at 25°C is a standard value, 72 dyne/cm, due to strong hydrogen bonding between water molecules.

19. Which of the following apparatus can be used for determining the surface tension of liquids [GPAT-2015]

(a) Ostwald viscometer

(b) Rheometer

(c) Du Nouy tensiometer

(d) Coulter counter

19. Which of the following apparatus can be used for determining the surface tension of liquids [GPAT-2015]

(a) Ostwald viscometer

(b) Rheometer

(c) Du Nouy tensiometer

(d) Coulter counter

Explanation:

METHODS OF MEASURING OF SURFACE TENSION & INTERFACIAL TENSION

S.NO.	METHODS USED	USED FOR MEASUREMENT OF	EQUATION USED
1.	Capillary Rise Method	for surface tension	γ = 1/2rphg (young LaPlace equation
2.	Drop weight method	for surface tension and Interfacial Tension	γ = w/2πr weight of one drop
3.	Drop count method	for surface tension and Interfacial Tension	γ = mg/2π m-mass of one drop n-no of drop

S.NO.	METHODS USED	USED FOR MEASUREMENT OF	EQUATION USED
4.	Wilhelmy's plate method	for surface tension and Interfacial Tension	$\gamma = W_L\text{-}W/2(L+T)$ WL-Reading (prior) W-weight of plate L, T-Length, thickness
5.	Ring detachment or	for surface tension and Interfacial Tension	$\gamma = \frac{P\times\beta}{2\pi(r1+r2)}$ $\gamma = \frac{\text{Diel Reading}\times\beta}{2\times\text{Ring circumference}}$ β – Correction factor

20. Chemically, spans are also called as [GPAT-2015]

(a) Sorbitan esters of fatty acids

(b) Polyxyethylene sorbitan esters of fatty acids

(c) Fatty acid-polyethylene glycol esters

(d) Alcohol-polyethylene glycol esters

20. Chemically, spans are also called as [GPAT-2015]

(a) Sorbitan esters of fatty acids

(b) Polyxyethylene sorbitan esters of fatty acids

(c) Fatty acid-polyethylene glycol esters

(d) Alcohol-polyethylene glycol esters

Explanation:

SURFACTANT

Hydrophobic: -Spans [Surbiton fatty acid esters

Hydrophilic: - Tweens [Polysorbates]

Polyoxy ethylene mono Laurate→ 20 L→ Tween 20 [L]

Polyoxy ethylene mono Mirasole→ 40 M→ Tween 40 [M]

Polyoxy ethylene mono Palmitate → 60 P→ Tween 60 [P]

Polyoxy ethylene mono Oleate→ 80 0→ Tween 80 [0]

21. Surface tension can be expressed in terms of [GPAT-2014]

(a) Force per unit length

(b) Energy per unit area increase

(c) Pressure difference across curved surface

(d) All of these

21. Surface tension can be expressed in terms of [GPAT-2014]

(a) Force per unit length

(b) Energy per unit area increase

(c) Pressure difference across curved surface

(d) All of these

Explanation:

SURFACE TENSION

- Surface tension is an amount of energy required to stretch or increase the surface of a liquid by unit area.
- The property of the surface of a liquid that allows it is resist an external force, due to the cohesive nature of its molecules.
- Surface tension is a measure of the elastic force (Strength) in the surface of a liquid
- Intermolecular forces are increased then surface tension is also increased

S.NO.	IN TERMS OF	EQUATION USED	ABBREVIATIONS
1.	Force per unit length	$Y = \frac{F}{2L}$	Y→Surface or Interfacial temian F→Force applied L→Length of bar
2.	Energy per unit area. Increases	$Y = \frac{W}{\Delta A}$	W→ Workneeded to displice bar ΔA →Increase in areas
3.	Pressure difference across curved surface	$\Delta P = Y \frac{1}{r_1} + \frac{1}{r_2}$	$r_1 r_2$ → Radii of Curvature ΔP →Pressure difference

22. 'Draves test' is associated with measuring the efficiency of [GATE-2008, GPAT-2014]

(a) Detergent

(b) Wetting agents

(c) Suspending agents

(d) Adsorbent

22. 'Draves test' is associated with measuring the efficiency of [GATE-2008, GPAT-2014]

(a) Detergent

(b) Wetting agents

(c) Suspending agents

(d) Adsorbent

Explanation:

DRAVE'S TEST

- Drave's test is used for the efficiency of a wetting agent based on the time required for a standard skein of cotton yarn carrying a standard weight to sink in a water solution of that wetting agent.
- One of the best known wetting tests being that of Draves.
- The Draves test involves measuring the time for a weighted skin of cotton yarn to sink through the wetting solution contained in a 500-ml graduate.

23. **Myrj 52 is [GPAT-2013]**

(a) Sodium oleate

(b) Polyoxy ethylene lauryl ether

(c) Polyoxy ethylene Mono-stearate

(d) Polyoxy ethylene castor oil

23. Myrj 52 is [GPAT-2013]

(a) Sodium oleate

(b) Polyoxy ethylene lauryl ether

(c) Polyoxy ethylene Mono-stearate

(d) Polyoxy ethylene castor oil

Explanation: Myrj 52

PREPARATION	SYNONYM	USE
Surbiton esters	Spans	Non-ionic surfactant
Polymer of ethylene oxide	Macrogols	Non-ionic surfactant
Polysorbates - polyethylene glycol derivatives of sobitan esters	Tweens	Non-ionic surfactant
Polyoxy ethylene mono stearate	Myrj 52	
Polysorbate and cetoestryl alcohol	Polywax	Non-ionic surfactant

24. Hydroxy ethyl carboxy methyl alkyl imidazolium hydroxide is a amphoteric surfactant which is known as [GPAT-2013]

(a) Macrogol

(b) Miranol

(c) Poly vinyl pyrrolidone

(d) Povidone

24. Hydroxy ethyl carboxy methyl alkyl imidazolium hydroxide is a amphoteric surfactant which is known as [GPAT-2013]

(a) Macrogol

(b) Miranol

(c) Poly vinyl pyrrolidone

(d) Povidone

- **Explanation:**
- Miranol Ultra L-32 is an ultra-pure mild amphoteric surfactant, imidazoline derivative.
- The brand name of Disodium Coco amphopropionate is Miranol.
- It is an example for amphoteric surfactant.
- IUPAC Name: 1-Carboxy methyl-1-(2-hydroxy ethyl)-2-undecyl-2-imidazolinium hydroxide disodium salt

25. Which of the following isotherms are produced when the heat of condensation of successive layers is more than the heat of adsorption of first layer [GPAT-2011]

(a) Type III and IV

(b) Type II and V

(c) Type I and II

(d) Type III and V

25. Which of the following isotherms are produced when the heat of condensation of successive layers is more than the heat of adsorption of first layer [GPAT-2011]

(a) Type III and IV

(b) Type II and V

(c) Type I and II

(d) Type III and V

Explanation:

ADSORPTION ISOTHERM

- The relationship between the amount of gas physically adsorbed on a soild and the equilibrium pressure or concentration at constant temperature yields an adsorption isotherm.
- The number of moles, grams, or millilters (x) of a gas adsorbed on (m) grams of adsorbent at standard temperature and pressure is plotted on the vertical axis against the equilibrium pressure of the gas on the horizontal axis.

Type I isotherm:	**Type II isotherm:**
• It is also called Langmuir isotherm. • It exhibits a rapid rise in adsorption up to a limiting value. • This type is restricted to a monolayer, hence chemisorption give this type of isotherm.	• It represents multilayer physical adsorption on non-porous materials.

Type III and type V isotherms:	Type IV and type V isotherms
• These isotherms are typical of vapor adsorption (i.e water vapor on hydrophobic materials). • This type of isotherm occurs when the heat of condensation of successive layers is more than the heat of adsorption of first layer.	• This type of isotherm occurs due to condensation of vapour in fine capillary of the solid. • It involves hysteresis.

26.

Calfactant is [GATE-2008]

[P] A sterile non-pyrogenic lung surfactant intended for intratracheal instillation to premature infants

[Q] A synthetic surfactant popularly used to prepare total parenteral nutrition to premature infants

[R] A potent chelating agent used to prevent metal induced oxidation process

[S] An extract of natural surfactant from calf lungs

(a) [P], [Q]
(b) [R], [S]
(c) [P], [S]
(d) [Q], [R]

26.

Calfactant is [GATE-2008]

[P] A sterile non-pyrogenic lung surfactant intended for intratracheal instillation to premature infants

[Q] A synthetic surfactant popularly used to prepare total parenteral nutrition to premature infants

[R] A potent chelating agent used to prevent metal induced oxidation process

[S] An extract of natural surfactant from calf lungs

(a) [P], [Q]

(b) [R], [S]

(c) [P], [S]

(d) [Q], [R]

Explanation:

- Calfactant is intratracheal suspension and it is a sterile non-pyrogenic lung surfactant which is intended for intratracheal instillation to premature infants.

- It is an extract of natural surfactant from calf lungs and includes phospholipids, neutral lipids, and hydrophobic surfactant associated protein B and C.

- It is an off-white suspension in 0.9% aqueous NaCl solution. It contains no preservatives.

- Clinically calfactant improves oxygenation and lung compliance.

27. The properties of solutions containing surface active agents change sharply over a narrow concentration range is called as [GATE-2006]

(a) Critical micellar concentration

(b) Ionic concentration

(c) Hydrogen ion concentration

(d) Surface tension

27. The properties of solutions containing surface active agents change sharply over a narrow concentration range is called as [GATE-2006]

(a) Critical micellar concentration

(b) Ionic concentration

(c) Hydrogen ion concentration

(d) Surface tension

Explanation:

- Critical micelle concentration, CMC, is defined as the concentration range of a surfactant at which micelles start forming.
- CMC is a concentration range and has the unit of concentration such as w/w, w/v per cent, moles/liter and moles/1000 g of solvent.

The phenomenon of micelle formation is as follows:

  - Below CMC, surface active agents preferentially get adsorbed at air- water interface.

- As the concentration of surfactant increases, molecules get accumulated progressively at the interface. In this process, at one particular concentration, the interface gets saturated, while the bulk phase is saturated with monomers. The formation of micelles is so spontaneous that it is difficult to differentiate the concentrations related to saturated phase and micelle phase. In the bulk of the solution, both monomers and micelles are in dynamic equilibrium. This concentration is called as CMC. Beyond CMC, any further addition of surface-active agents enhances the formation of micelles only.

- This process is spontaneous, i.e. the free energy of the system is reduced. Preparation of association colloids is easy for this reason. Adhesive forces are well balanced, which is possible only in the bulk of the solution. Hence, micelles remain in the bulk of the solution, i.e. not surface active.

28. **The correct non-ionic surfactant used as a penetration enhancer in the preparation of mucoadhesive [GATE-2003]**

(a) Oleic acid

(b) Tween-80

(c) Glycerol

(d) Propylene glycol

28. The correct non-ionic surfactant used as a penetration enhancer in the preparation of mucoadhesive [GATE-2003]

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(b) Tween-80

(c) Glycerol

(d) Propylene glycol

Explanation:

MUCOADHESIVE SYSTEM

- A bioadhesive polymer such as cross-linked polyacrylic acid, when incorporated in a tablet, allows it to adhere to the gastric mucosa or epithelium is called mucoadhesive. Such a system continuously releases a fraction of drug into the intestine over prolonged periods of time

PENETRATION ENHANCERS

- Compounds which facilitate the transport of drugs across the biomembrane are called as penetration/permeation enhancers or promoters. This method is used mainly in cases of hydrophilic drugs which are expected to have difficulty in penetrating the lipid structure of the biomembrane. Penetration enhancers act interaction of its lipid part with the polar component of membrane phospholipids.
  - Tween 80 is the non-ionic surfactant which is polyoxyethylene derivative of spas. It has both hydrophilic and lipophilic characteristics and hence it is used as penetration enhancers.

- Glycerol and propylene glycol are used as co-solvents
- Oleic acid is classified as emulsion adjunct which reacts with alkalies to form soaps which act as emulgent

29. **HLB system is used to classify [GATE-2002]**

(a) Surfactants

(b) Preservatives

(c) Antioxidants

(d) Sequestering agents

29. HLB system is used to classify [GATE-2002]

(a) Surfactants

(b) Preservatives

(c) Antioxidants

(d) Sequestering agents

Explanation:

- The HLB value helps determine whether a surfactant is more hydrophilic (high HLB) or lipophilic (low HLB), which is critical in selecting emulsifiers for oil-in-water or water-in-oil emulsions.
- Agents with HLB value of 1-8 are lipophilic and suitable for preparation of w/o emulsion.
- Those with HLB value of 8-18 are hydrophilic and good for o/w emulsion.

30. H.L.B values are given. Match them with correct surfactant [GATE-2000]

1.0-3	[P] Solubilizing agent
2.4-6	[Q] Detergent
	[R] Antifoaming agent
	[S] W/O emulgents

(a) 1 - [Q] 2 - [S]

(b) 1 - [R] 2 - [S]

(c) 1 - [R] 2 - [P]

(d) 1 - [P] 2 - [S]

30. H.L.B values are given. Match them with correct surfactant [GATE-2000]

1.0-3	[P] Solubilizing agent
2.4-6	[Q] Detergent
	[R] Antifoaming agent
	[S] W/O emulgents

(a) 1 - [Q] 2 - [S]

(b) 1 - [R] 2 - [S]

(c) 1 - [R] 2 - [P]

(d) 1 - [P] 2 - [S]

- **Explanation:**

Hydrophilic Lipophilic Balance (HLB) system

- Developed by Griffin in 1949.
- Definition: The hydrophile lipophile balance (HLB)system is an arbitrary scale for expressing the hydrophilic and lipophilic characteristics of an emulsifying agent.
- Agents with HLB value of 1-8 are lipophilic and suitable for preparation of w/o emulsion,
- Those with HLB value of 8-18 are hydrophilic and good for o/w emulsion.

HLB value		Application
1 -3	-	Anti-foaming agent.
3 -6	-	**W/O emulsifying agents.**
7 -9	-	Wetting agents.
8 -18	-	**O/W emulsifying agents.**
13 -15	-	Detergents.
15 -18	-	Solubilizing Agents.

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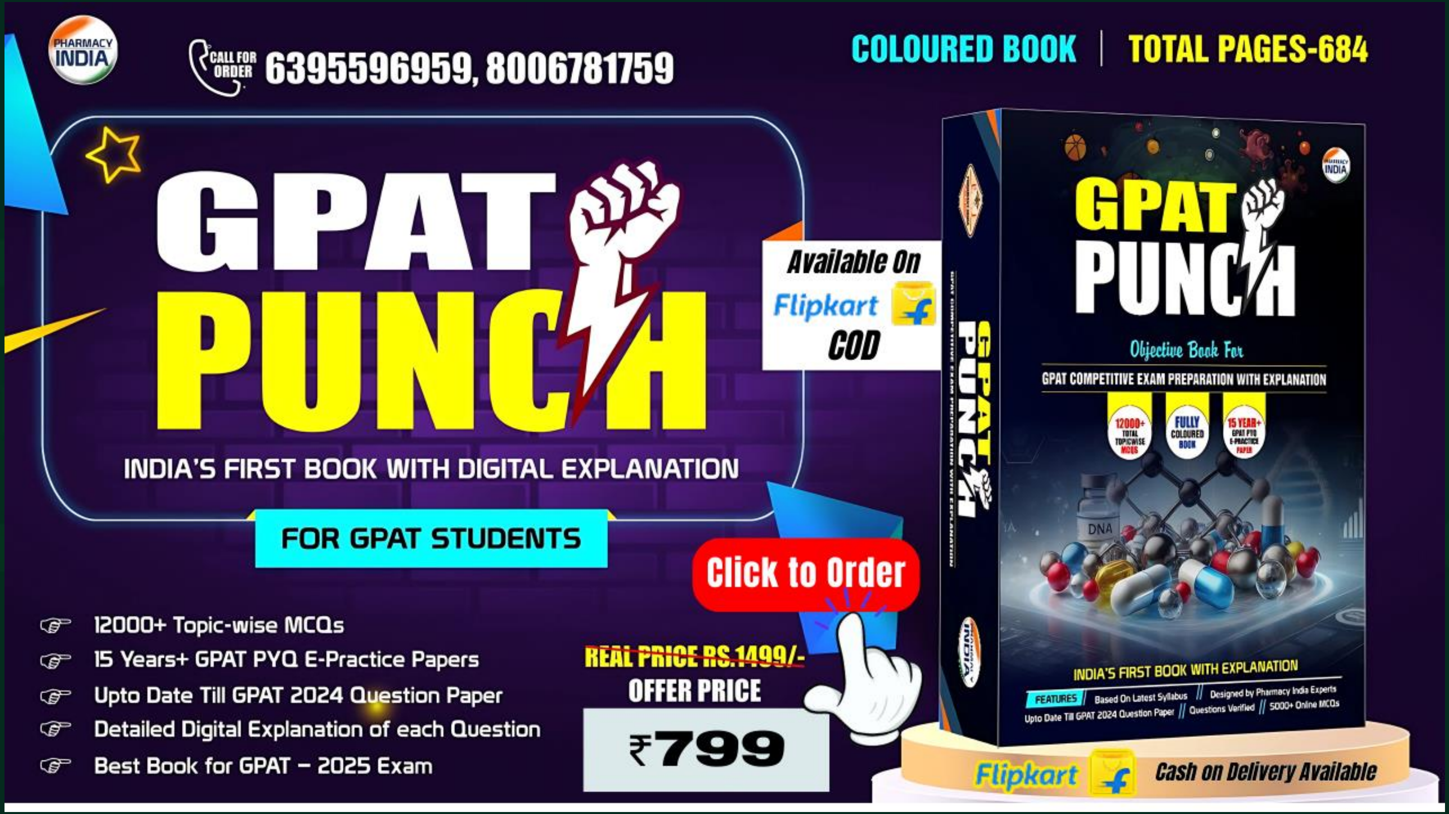

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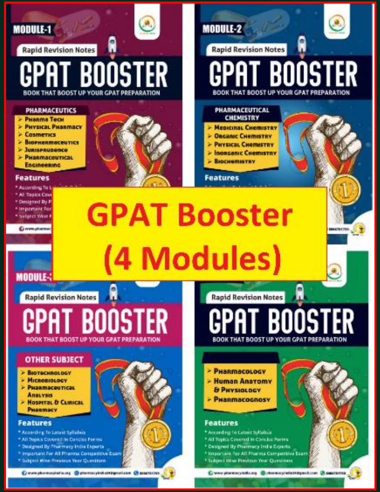
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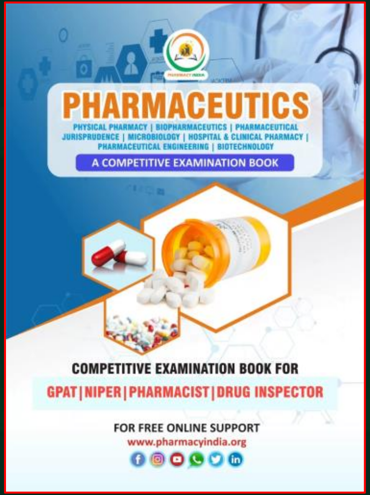
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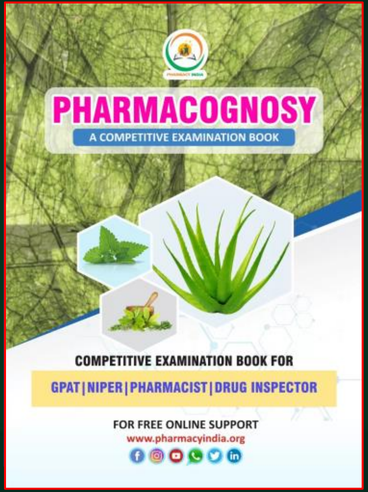
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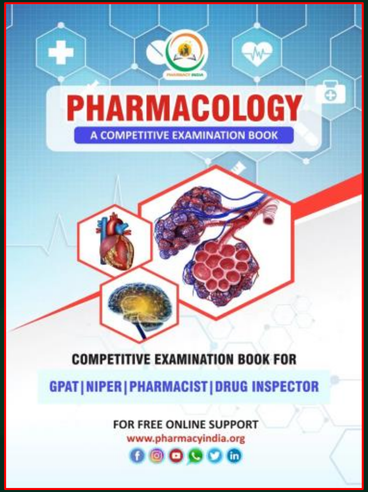
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31. Benzalkonium chloride is a germicidal surfactant which is rendered inactive in the presence of [GATE-1994]

(a) Organic acid

(b) Cationic surfactants

(c) Soaps

(d) Inorganic salts

31. Benzalkonium chloride is a germicidal surfactant which is rendered inactive in the presence of [GATE-1994]

(a) Organic acid

(b) Cationic surfactants

(c) Soaps

(d) Inorganic salts

Explanation:

Benzalkonium Chloride:

- It is a **cationic surfactant** and widely used as a germicidal agent in disinfectants and antiseptics.
- The antimicrobial activity of benzalkonium chloride arises from its ability to disrupt microbial cell membranes.

- **Option (a): Organic Acid:**

- Organic acids typically reduce the pH, which may enhance the germicidal activity of cationic surfactants rather than inactivating them. Thus, this option is incorrect.

Option (b): Cationic Surfactants:

- Cationic surfactants do not render benzalkonium chloride inactive. Instead, they often synergize with each other due to similar mechanisms of action. Therefore, this option is incorrect.

Option (c): Soaps:

- Soaps are **anionic surfactants**, and they chemically interact with cationic surfactants like benzalkonium chloride.
- This interaction neutralizes the positive charge of benzalkonium chloride, rendering it inactive.

- This is a classic case of **antagonism between cationic and anionic compounds.** Hence, this option is correct.

Option (d): Inorganic Salts:

- While some inorganic salts may reduce the activity of cationic surfactants by ionic strength effects, they do not entirely inactivate benzalkonium chloride. Therefore, this option is incorrect.

32. Surfactants are characterized by the presence of [GATE-1993]

(a) Water solubilizing groups alone

(b) Fat solubilizing groups alone

(c) Water and fat solubilizing groups in the same molecule

(d) Groups with positive charge

32. Surfactants are characterized by the presence of [GATE-1993]

(a) Water solubilizing groups alone

(b) Fat solubilizing groups alone

(c) Water and fat solubilizing groups in the same molecule

(d) Groups with positive charge

- **Explanation:**

Understanding Surfactants:

  - Surfactants, also called surface-active agents, are compounds that lower surface tension between two liquids, a gas and a liquid, or a liquid and a solid.
  - They are amphiphilic in nature, meaning they contain both hydrophilic (water-loving) and lipophilic (fat-loving) groups.

Option (a): Water solubilizing groups alone:

- This is incorrect because surfactants are not solely hydrophilic. They require both hydrophilic and lipophilic groups to function effectively.

Option (b): Fat solubilizing groups alone:

- This is also incorrect because surfactants need to interact with both water and fat/oil phases to act as emulsifiers or detergents.

Option (c): Water and fat solubilizing groups in the same molecule:

- This is correct. Surfactants have:
  - A **hydrophilic head** that interacts with water.
  - A **lipophilic tail** that interacts with fats and oils.
- This dual nature allows surfactants to reduce surface tension and emulsify fats in water. For example, soaps and detergents exhibit this characteristic.

Option (d): Groups with positive charge:

- This is partially true for **cationic surfactants**, but not all surfactants carry a positive charge. Surfactants may also be anionic, nonionic, or zwitterionic. Thus, this option is incorrect.

33. Surfactants are characterized by the presence of [GATE-1992]

(a) Water solubilizing and fat solubilizing groups in the same molecule

(b) Only negative charges

(c) Only positive charges

(d) None of these

33. Surfactants are characterized by the presence of [GATE-1992]

(a) Water solubilizing and fat solubilizing groups in the same molecule

(b) Only negative charges

(c) Only positive charges

(d) None of these

Explanation:

- **Option (a): Water solubilizing and fat solubilizing groups in the same molecule:**
    - This is correct because surfactants possess both hydrophilic and lipophilic groups in the same molecule, allowing them to interact with polar and nonpolar substances simultaneously.

- **Option (b): Only negative charges**:
  - Incorrect. While **anionic surfactants** carry negative charges, not all surfactants have negative charges. Surfactants can also be **cationic (positive charge)**, **nonionic (no charge)**, or **zwitterionic (both positive and negative charges)**.
- **Option (c): Only positive charges**:
  - Incorrect. This applies only to **cationic surfactants**, which are a subset of surfactants. However, not all surfactants carry positive charges.

- **Option (d): None of these**:
  - Incorrect. The defining feature of surfactants is their **amphiphilic structure**, as described in option (a).

34. **Bubble point test is done to determine [GATE-1992]**

(a) The surface tension of the liquid in capillary tubes

(b) The viscosity of the liquid in ampoules

(c) The pH of a 1% solution

(d) The volume of the solution stored in a specified container

34. Bubble point test is done to determine [GATE-1992]

(a) The surface tension of the liquid in capillary tubes

(b) The viscosity of the liquid in ampoules

(c) The pH of a 1% solution

(d) The volume of the solution stored in a specified container

Explanation:

Bubble Point Test:

- The bubble point test is a technique used to measure the **surface tension** of a liquid, particularly when it rises in small capillaries.
- It is based on the principle that the pressure required to form a bubble at the tip of a submerged capillary depends on the **surface tension** of the liquid and the diameter of the capillary.

How It Works:

- A liquid-filled capillary tube is subjected to increasing pressure.
- The smallest pressure at which a bubble forms at the tip of the tube correlates with the surface tension, following the **Laplace equation**.

35. Given below are some of the associate colloids, Match the correct type from the list [P] to [S] [GATE-1990]

1. Sodium lauryl sulphate	[P] Anionic
2. Cetyl trimethyl ammonium bromide	[Q] Cationic
4. Dimethyl dodecyl ammonio propane sulphate	[R] Nonionic
3. Polyoxyethylene lauryl ether	[S] Ampholytics

(a) 1-[Q], 2-[P], 3-[S], 4-[R]

(b) 1-[P], 2-[Q], 3-[R], 4-[S]

(c) 1-[R], 2-[S], 3-[P], 4-[Q]

(d) 1-[P], 2-[Q], 3-[S], 4-[R]

35. Given below are some of the associate colloids, Match the correct type from the list [P] to [S] [GATE-1990]

1. Sodium lauryl sulphate	[P] Anionic
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3. Polyoxyethylene lauryl ether	[S] Ampholytics

(a) 1-[Q], 2-[P], 3-[S], 4-[R]

(b) 1-[P], 2-[Q], 3-[R], 4-[S]

(c) 1-[R], 2-[S], 3-[P], 4-[Q]

(d) 1-[P], 2-[Q], 3-[S], 4-[R]

Explanation:

- Sodium lauryl sulfate: Anionic surfactant.
- Cetyl trimethyl ammonium bromide: Cationic surfactant.
- Polyoxyethylene lauryl ether: Nonionic surfactant.
- Dimethyl dodecyl ammonio propane sulphate: Ampholytic surfactant.

36. The HLB value of span 20 is

(a) 6.5

(b) 13.8

(c) 25.0

(d) 8.6

36. The HLB value of span 20 is

(a) 6.5

(b) 13.8

(c) 25.0

(d) 8.6

Explanation:

HLB values of some common surface active agents

Surface active agents	HLB value
Oleic acid	1
Polyoxyethylene sorbitol beeswax derivative (G-1706)	2
Sorbitan tristearate	2.1
Glyceryl monostearate	3.8
Sorbitan monooleate (Span 80)	4.3
Diethylene glycol monostearate	4.7
Sorbitan monolaurate (Span 20)	8.6
Polyethylene lauryl ether (Brij 30)	9.5

Surface active agents	HLB value
Polyoxyethylene monostearate (Myrj 45)	11.1
Triethanolamine oleate	12
Polyoxyethylene sorbitan monooleate (Tween 80)	15
Polyoxyethylene sorbitan monolaurate (Tween 20)	16.7
Polyoxyethylene lauryl ether (Brij 35)	16.9
Sodium oleate	18
Potassium oleate	20
Sodium lauryl sulfate	40

37. Surface tension usually with increase in temperature

(a) Increase

(b) Constant

(c) Decrease

(d) All of these

37. Surface tension usually with increase in temperature

(a) Increase

(b) Constant

(c) Decrease

(d) All of these

Explanation:

1. Surface Tension:

- Surface tension arises due to cohesive forces between liquid molecules at the surface.
- These cohesive forces are stronger at lower temperatures because molecules have less kinetic energy and are more closely bonded.

2. Effect of Temperature:

- As the **temperature increases**, the kinetic energy of the liquid molecules also increases.

- This weakens the cohesive forces between molecules, resulting in a **decrease in surface tension.**

3. Scientific Relation:

- Surface tension is inversely related to temperature. Near the boiling point of the liquid, the surface tension approaches zero as the liquid transitions to a gaseous state.

38. Surface tension can be expressed in terms of

(a) Force per unit length

(b) Energy per unit area increase

(c) Pressure difference across curved surface

(d) All of these

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(a) Force per unit length

(b) Energy per unit area increase

(c) Pressure difference across curved surface

(d) All of these

Explanation:

S.NO.	IN TERMS OF	EQUATION USED	ABBREVIATIONS
1.	Force per unit length	$Y = \frac{F}{2L}$	Y→Surface or Interfacial temian F→Force applied L→Length of bar
2.	Energy per unit area. Increases	$Y = \frac{W}{\Delta A}$	W→ Workneeded to displice bar ΔA →Increase in areas
3.	Pressure difference across curved surface	$\Delta P = Y \frac{1}{r_1} + \frac{1}{r_2}$	$r_1 r_2$ → Radii of Curvature ΔP →Pressure difference

39. Measurement of surface and interfacial tensions can be carried out by following methods

(a) Capillary rise

(b) Ring detachment

(c) Wilhelmy plate

(d) All of these

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(a) Capillary rise

(b) Ring detachment

(c) Wilhelmy plate

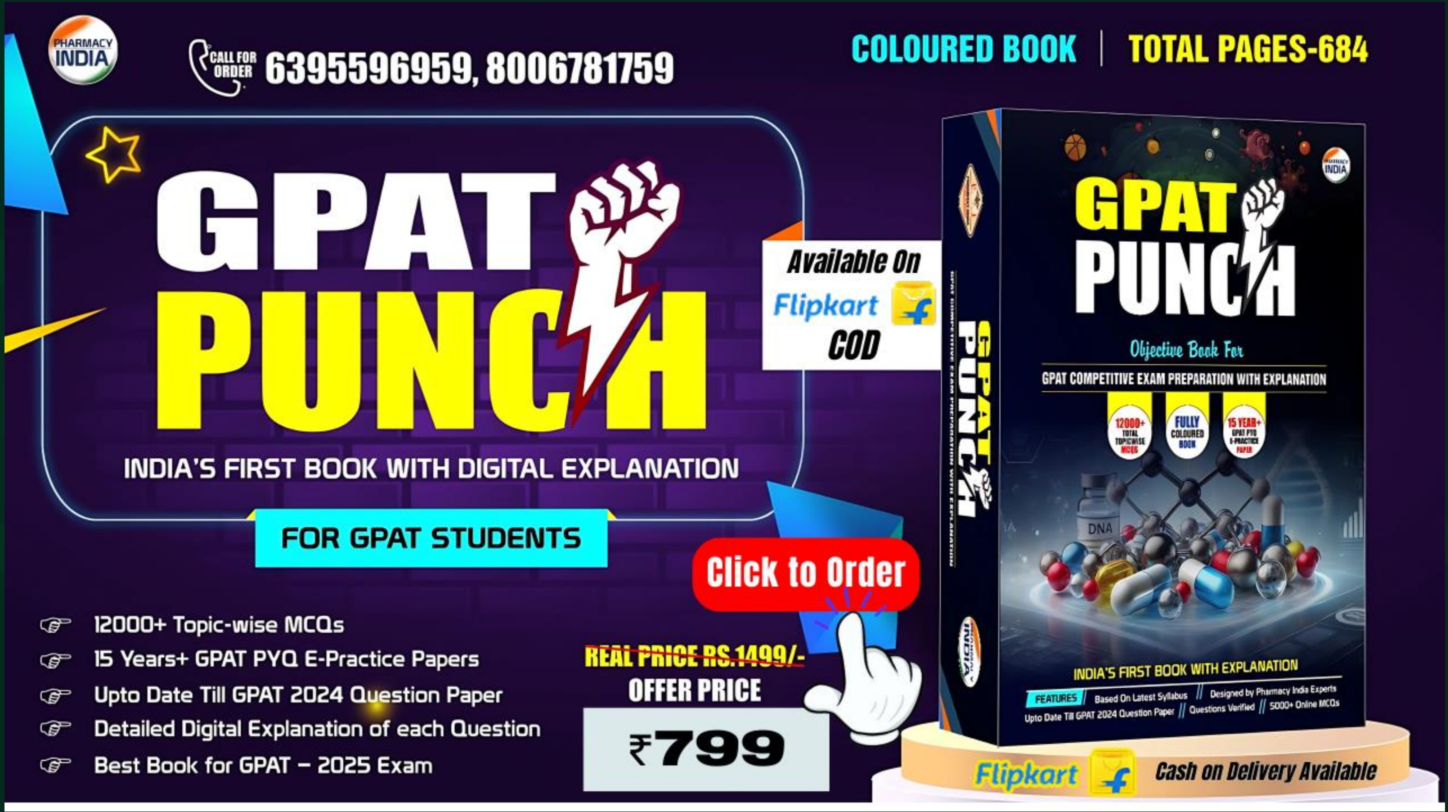
(d) All of these

Explanation:

METHODS OF MEASURING OF SURFACE TENSION & INTERFACIAL TENSION

S.NO.	METHODS USED	USED FOR MEASUREMENT OF	EQUATION USED
1.	Capillary Rise Method	for surface tension	γ = 1/2rphg (young LaPlace equation
2.	Drop weight method	for surface tension and Interfacial Tension	γ = w/2πr weight of one drop
3.	Drop count method	for surface tension and Interfacial Tension	γ = mg/2π m-mass of one drop n-no of drop

S.NO.	METHODS USED	USED FOR MEASUREMENT OF	EQUATION USED
4.	Wilhelmy's plate method	for surface tension and Interfacial Tension	$\gamma = W_L - W/2(L+T)$ WL-Reading (prior) W-weight of plate L, T-Length, thickness
5.	Ring detachment or	for surface tension and Interfacial Tension	$\gamma = \frac{P \times \beta}{2\pi(r1+r2)}$ $\gamma = \frac{\text{Diel Reading} \times \beta}{2 \times \text{Ring circumference}}$ β – Correction factor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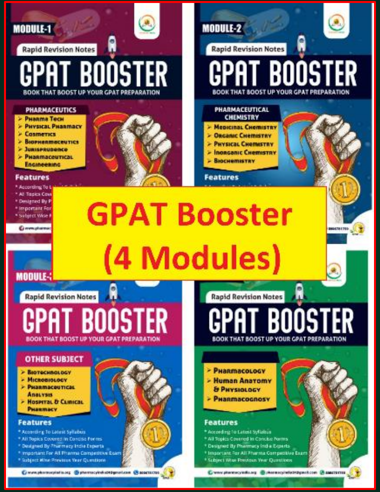
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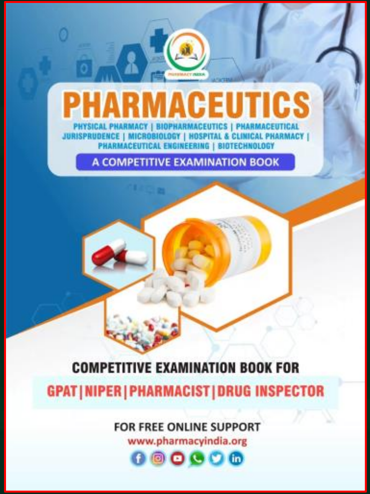
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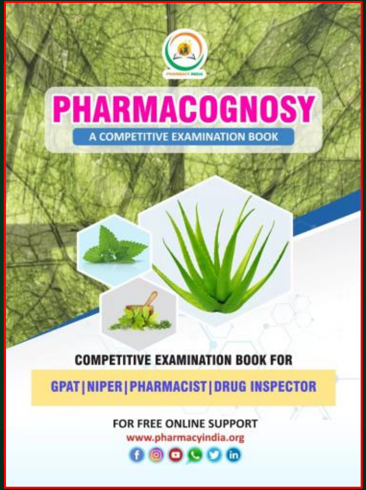
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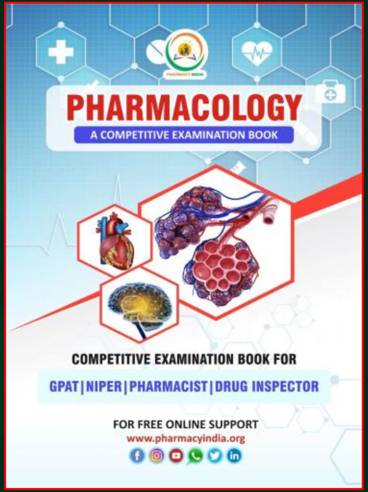
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40. Name the apparatus used in drop weight method of measurement of surface tension is –

(a) Potentiometer

(b) Melting apparatus

(c) Stalagmometer

(d) Manometer

40. **Name the apparatus used in drop weight method of measurement of surface tension is –**

(a) Potentiometer

(b) Melting apparatus

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(d) Manometer

Explanation:

Drop Weight Methods

Principle: If a liquid is allowed to fall slowly through a capillary tube, the liquid first forms a drop at the tip of the capillary tube, which gradually increases in size and finally detaches when the weight of the drop (W) equals the total surface tension at the circumference of the tube (2πr). Expressing mathematically,

$$W = 2\pi r \Upsilon$$

On the basis of the above principle, the surface tension of a liquid can be determined by either (1) the drop weight method or (2) the drop count method using a stalagmometer. The stalagmometer or drop pipette consists of a glass tube with a bulb blown approximately in the middle of the tube and a circular flattened end. There are two markings A and B on the tube, one above the bulb and the other below it. There is a capillary bore at the tip of the stalagmometer just above the flattened end.

41. ________ is the difference between work of adhesion and work of cohesion

(a) Spreading coefficient

(b) Diffusion

(c) Osmotic

(d) Boiling

41. __________ is the difference between work of adhesion and work of cohesion

(a) Spreading coefficient

(b) Diffusion

(c) Osmotic

(d) Boiling

Explanation:

- The spreading coefficient is the difference between the work of adhesion (energy required to spread a liquid over a surface) and the work of cohesion (energy required to maintain the integrity of the liquid).
- A positive spreading coefficient indicates that a liquid will spread on a surface, while a negative value suggests that it will not spread.

42. Spreading occurs when work of adhesion is ____ than work of cohesion

(a) Less

(b) More

(c) Equal

(d) None of these

42. Spreading occurs when work of adhesion is ____ than work of cohesion

(a) Less

(b) More

(c) Equal

(d) None of these

Explanation:

- Spreading occurs when the work of adhesion (the energy required to spread a liquid on a surface) is greater than the work of cohesion (the energy required to keep the liquid intact). This means that the attractive forces between the liquid and the surface exceed the attractive forces within the liquid itself, allowing the liquid to spread.

43. Surfactants contain polar and

(a) Hydrophilic

(b) Hydrophobic

(c) Nonpolar

(d) None of these

43. Surfactants contain polar and

(a) Hydrophilic

(b) Hydrophobic

(c) Nonpolar

(d) None of these

Explanation:

Surfactants are compounds that contain both a polar (hydrophilic) and a nonpolar (hydrophobic) part. The hydrophilic part is attracted to water, while the hydrophobic part is attracted to oils or nonpolar substances. This dual affinity allows surfactants to reduce surface tension and promote the mixing of water and oil.

44. Cetrimide is the example of

(a) Ionic

(b) Nonionic

(c) Anionic surfactant

(d) Ampholytic

44. Cetrimide is the example of

(a) Ionic

(b) Nonionic

(c) Anionic surfactant

(d) Ampholytic

Explanation:

TYPE CLASSIFICATION OF SURFACTANTS USED IN PHARMACEUTICAL EMULSION WITH EXAMPLES ARE GIVEN BELOW

SURFACTANT	EXAMPLES
Anionic surfactant	
Soaps	Sodium oleate
	Sodium palmitate
Sulphates	Sodium lauryl sulphate
Ether sulphates	Sodium laureth Sulphate
Benzene sulphonate	4-benzyl dodecane, Sulphonate Sodium
Hemiesters	Sodium dioctyl
	Sulphosuccinate
Sarcoides	Lauryl sarcosinate

SURFACTANT	EXAMPLES
Anionic surfactant	
Miscellaneous	Cetrimide Cetylpyridinium chloride
Cationic surfactant	
Amines	Tetradecyl methyl amine, Cetyl trimethyl Ammonium bromide
Quartenary ammoniums	Benzalkonium chloride
	Hexadecyl trimethyl
	Ammonium chloride

SURFACTANT	EXAMPLES
Non-ionic surfactant	
Ethoxylated alcohols	Tridecanol
Etoxylated amides	Di acyl ethoxy urea
Fatty acid esters	Sorbitan monosterate
	Polyoxyethylene sorbitan monolaurate, Polyoxyethylene sorbitan mono-oleate
	Glycerol trimer
Ampholytic surfactants	
Ammonium phosphate	Lecithin
Amino propionic	
Quartenary compounds	Betain, Sulfobetain

45. Ampholytic surfactants at intermediate pH behave as

(a) Cationic

(b) Zwitterions

(c) Anionic

(d) Nonionic surfactants

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(a) Cationic

(b) Zwitterions

(c) Anionic

(d) Nonionic surfactants

Explanation:

- Ampholytic surfactants possess both cationic and anionic groups, allowing them to behave as zwitterions at intermediate pH levels.
- This means that at certain pH values, they can have both positive and negative charges, leading to unique properties such as the ability to reduce surface tension and act as effective detergents.

46. What is the primary function of the electrical double layer around a solid particle in a dispersion medium?

(a) Neutralizes the charge on the particle

(b) Prevents particle aggregation

(c) Allows adsorption of hydronium ions

(d) Both (a) and (b)

46. What is the primary function of the electrical double layer around a solid particle in a dispersion medium?

(a) Neutralizes the charge on the particle

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(c) Allows adsorption of hydronium ions

(d) Both (a) and (b)

Explanation:

- **Electrical Double Layer:**
  - The **electrical double layer** forms at the interface between a solid particle and a dispersion medium. It consists of:
  - A **tightly bound layer** of counterions near the solid surface.
  - A **diffuse layer** of ions distributed in the surrounding medium.

- **Primary Functions**:
  - ○ **Neutralizes the charge on the particle**:
    - ✓ The double layer neutralizes the surface charge of the particle, maintaining the overall charge balance in the dispersion medium.
    - ✓ This is essential for stabilizing the dispersion.

- **Prevents particle aggregation**:
  - ✓ By creating a charged layer around the particles, the electrical double layer generates **electrostatic repulsion** between particles.
  - ✓ This prevents particles from coming too close and aggregating, ensuring stability in colloidal systems.

47. The concentration at which monomeric surfactant molecules associate to form micelles

(a) HBO

(b) DLVO

(c) HLB

(d) CMC

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(a) HBO

(b) DLVO

(c) HLB

(d) CMC

Explanation:

1. Critical Micelle Concentration (CMC):

- CMC is the concentration at which **monomeric surfactant molecules** in a solution aggregate to form **micelles**.
- Below the CMC, surfactants exist as individual molecules. Above the CMC, they form micelles, which are aggregates with a hydrophobic core and a hydrophilic surface.

2. Significance of CMC:

- At the CMC, the solution properties (e.g., surface tension, electrical conductivity) change significantly due to micelle formation.
- Micelles are important for solubilizing hydrophobic substances, enhancing detergency, and stabilizing emulsions.

48. At particular temperature micelles are more soluble than monomers that point is known as

(a) Kraft point

(b) Cloud point

(c) Melting point

(d) Boiling point

48. At particular temperature micelles are more soluble than monomers that point is known as

(a) Kraft point

(b) Cloud point

(c) Melting point

(d) Boiling point

Explanation:

1. Kraft Point (Kraft Temperature):

- The **Kraft point** is the temperature above which surfactant molecules form micelles and become more soluble in water compared to their monomeric form.
- Below the Kraft point, surfactant solubility is low, and monomers predominate, often forming precipitates or crystalline phases.

2. Significance of the Kraft Point:

- Above the Kraft point:
    - Surfactants exhibit increased solubility.
    - Micelle formation begins, enhancing their functionality in applications like detergency and solubilization.
- Below the Kraft point:
    - Surfactants have limited solubility, and monomers do not associate into micelles.

49. _______ are the ions with charge opposite to that carried by the micelles

(a) Gegenions

(b) Quantum ions

(c) Faraday ions

(d) All of these

49. ________ are the ions with charge opposite to that carried by the micelles

(a) Gegenions

(b) Quantum ions

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(d) All of these

- **Explanation:**

1. **Gegenions:**
    - Gegenions, also called **counterions**, are ions in a solution that carry a charge **opposite to that of the micelle**.
    - For example, in the case of an anionic surfactant micelle (negative charge), the gegenions are positively charged ions (e.g., Na^+ in sodium lauryl sulfate).

2. Role of Gegenions:

- Gegenions neutralize the charge of micelles, contributing to the stability of the system by forming an **electrical double layer** around the micelles.
- This reduces repulsion between similarly charged micelles and enhances their functionality in colloidal systems.

50. CMC ______ on addition of salts

(a) Constant

(b) Increase

(c) Decreases

(d) All of these

50. CMC ________ on addition of salts

(a) Constant

(b) Increase

(c) Decreases

(d) All of these

Explanation:

1. Effect of Salts on Critical Micelle Concentration (CMC):

- **CMC decreases** with the addition of salts because salts reduce the repulsion between the head groups of surfactant molecules.
- Salts, especially electrolytes, shield the charges on ionic surfactant molecules, allowing the surfactant monomers to aggregate and form micelles at lower concentrations.

2. Mechanism:

- Salts like $NaCl$ or $CaCl_2$ neutralize the electrostatic repulsion between similarly charged surfactant head groups (e.g., in anionic surfactants like sodium lauryl sulfate).
- This facilitates micelle formation, reducing the concentration required to reach the CMC.

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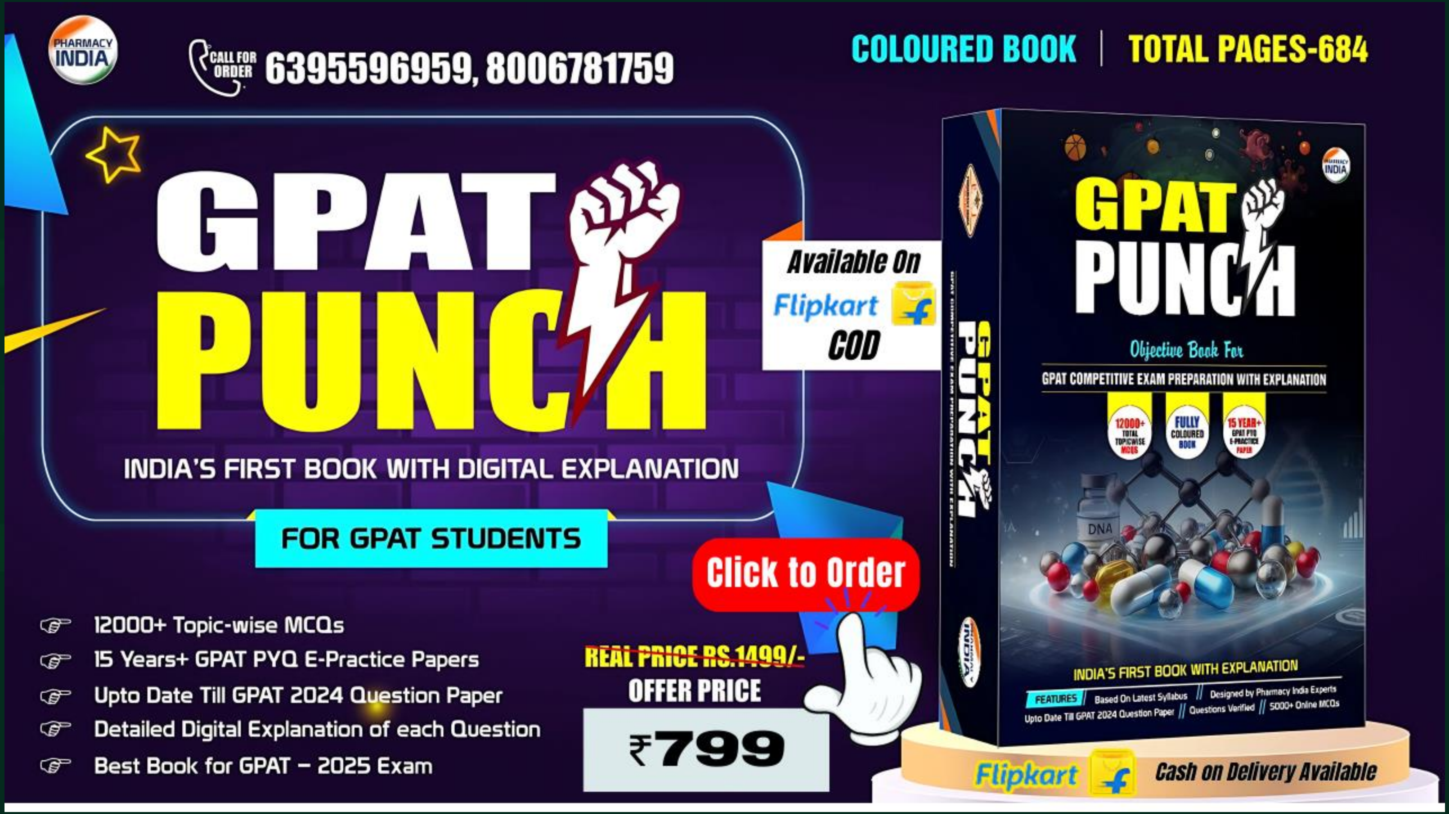

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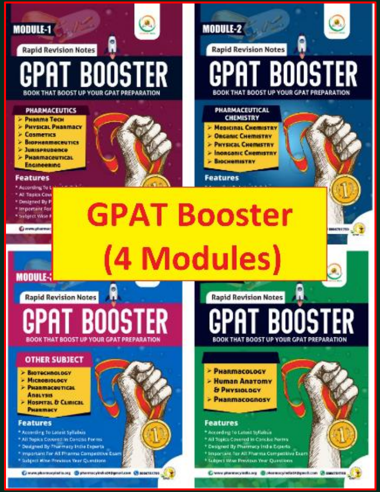

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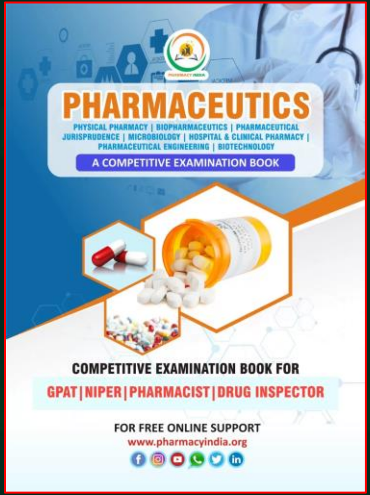

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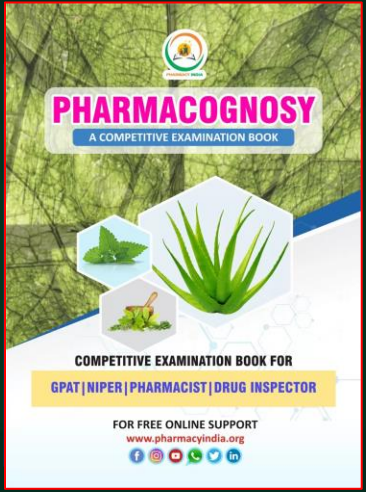

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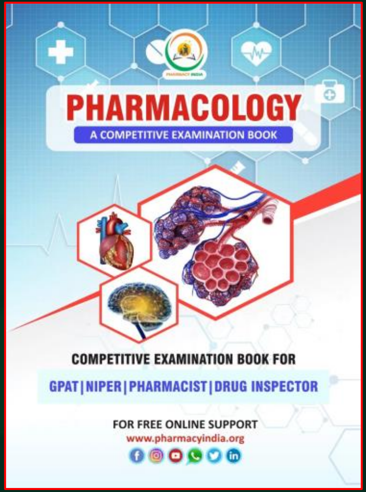

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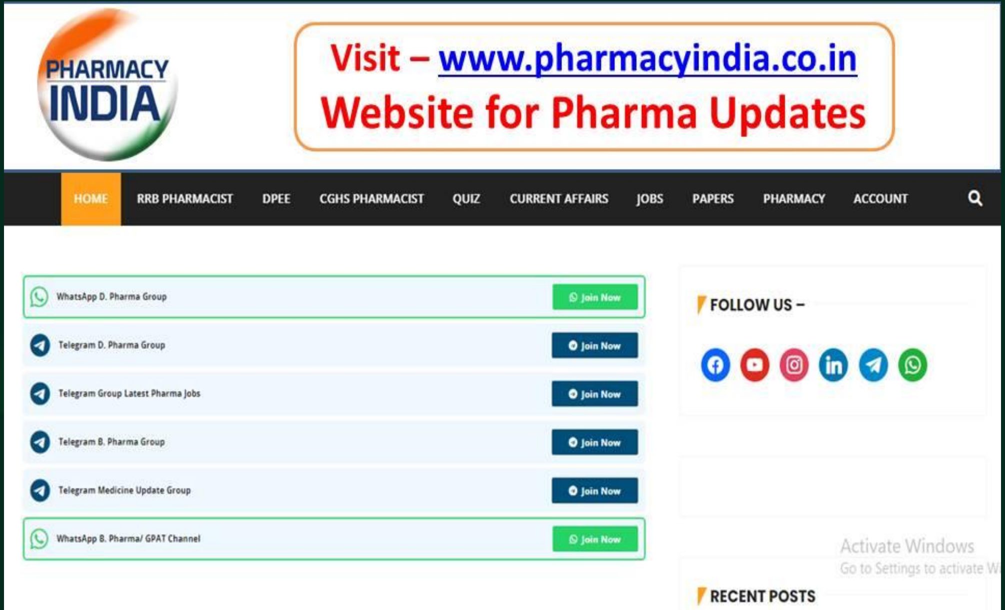

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