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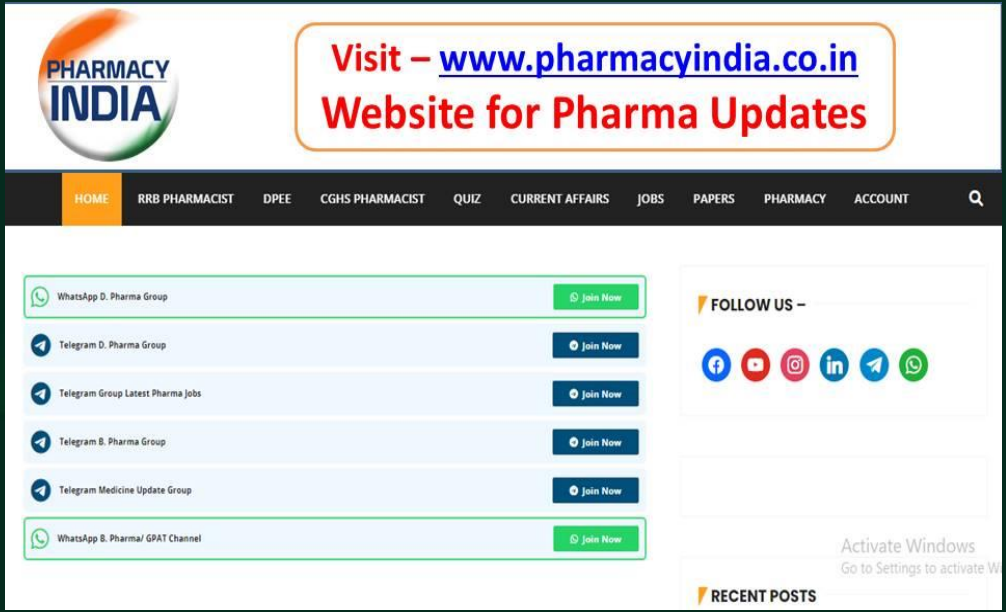

1. The formula to calculate liquid pressure is (GPAT-2023 SHIFT-1]

(a) P = mgh

(b) P = wgh

(c) P = ρgh

(d) P = Fgh

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1. **The formula to calculate liquid pressure is (GPAT-2023 SHIFT-1]**

(a) $P = mgh$

(b) $P = wgh$

(c) $P = \rho gh$

(d) $P = Fgh$

- **Explanation**:

(a) $P = mgh$: This equation calculates gravitational potential energy, where m is mass, g is the acceleration due to gravity, and h is height.

(b) $P = wgh$: This equation is a variation that represents pressure in terms of weight, but it's less commonly used than the density form.

(c) $P = \rho gh$: This is the correct formula for calculating the liquid pressure at a certain depth, where P is the pressure, ρ (rho) is the density of the liquid, g is the acceleration due to gravity, and h is the height (or depth) of the liquid column.

(d) $P = Fgh$: This equation is incorrect as it improperly uses force in the context of pressure calculation.

2. If u is velocity of fluid, p is density of fluid, L is length of the pipe, D is diameter of the pipe, f is friction factor and ΔP1 is pressure drop, then the equation ΔP1 = (2fu2Lρ) ÷ D represents [GPAT-2023 SHIFT-1]

(a) Hagen-Poiseuille equation

(b) Bernoulli equation

(c) Fanning's equation

(d) Reynolds equation

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(a) Hagen-Poiseuille equation

(b) Bernoulli equation

(c) Fanning's equation

(d) Reynolds equation

- **Explanation:**
- Fanning's equation: Describes the pressure drop due to friction in a pipe for turbulent flow. The friction factor f accounts for losses in energy due to the viscosity of the fluid and the roughness of the pipe.

$$\Delta P = \frac{2fL\rho u^2}{D}$$

Where:

•ΔP\Delta PΔP = Pressure drop (Pa or N/m^2)
•fff = Fanning friction factor (dimensionless)
•LLL = Length of the pipe (m)
•ρ\rhoρ = Density of the fluid (kg/m^3)
•uuu = Velocity of the fluid (m/s)
•DDD = Diameter of the pipe (m)

3. **Differential manometer has advantage over simple manometer [GPAT-2021]**

(a) Handling is simple

(b) It can measure smaller pressure difference

(c) Viscosity can be determined along with pressure difference

(d) It is used when pressure difference is high

3. **Differential manometer has advantage over simple manometer [GPAT-2021]**

(a) Handling is simple

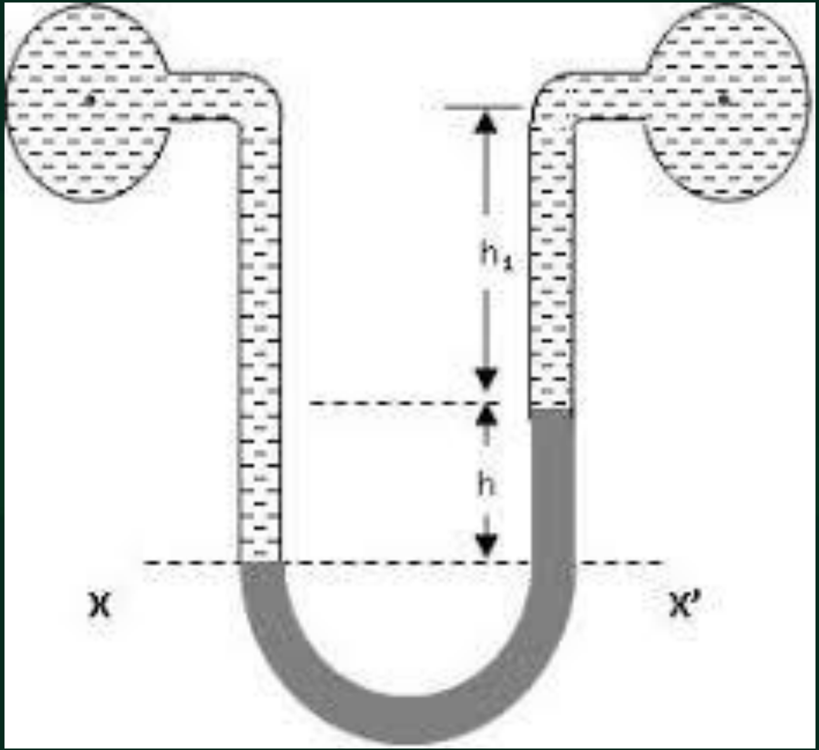
(b) It can measure smaller pressure difference

(c) Viscosity can be determined along with pressure difference

(d) It is used when pressure difference is high

- **Explanation:**

- It can measure smaller pressure difference: This is true. Differential manometers are sensitive and can detect very small pressure differences, making them more suitable for precise measurements compared to simple manometers, which might not be as sensitive.



h_1
h
X
X'

4. Which of the following fluid can be considered as an ideal fluid [GPAT-2018]

(a) Viscous fluid

(b) Non-viscous fluid

(c) Compressible fluid

(d) All of these

4. Which of the following fluid can be considered as an ideal fluid [GPAT-2018]

(a) Viscous fluid

(b) Non-viscous fluid

(c) Compressible fluid

(d) All of these

- **Explanation:**

An ideal fluid is defined as a fluid that possesses the following characteristics:

- Non-viscous: It has no viscosity, meaning it experiences no internal friction when layers of fluid move past one another.

- Incompressible: Its density remains constant, regardless of pressure changes.

- Irrotational: It has no rotation or turbulence in flow.

Given these characteristics, non-viscous fluids fit the definition of ideal fluids.

5. **Foaming during liquid filling can be reduced by following ways, EXCEPT [GPAT-2017]**

(a) Increase in speed of the filling line

(b) Minimized product turbulence

(c) Closed system filling

(d) Defoaming device

5. **Foaming during liquid filling can be reduced by following ways, EXCEPT [GPAT-2017]**

(a) Increase in speed of the filling line

(b) Minimized product turbulence

(c) Closed system filling

(d) Defoaming device

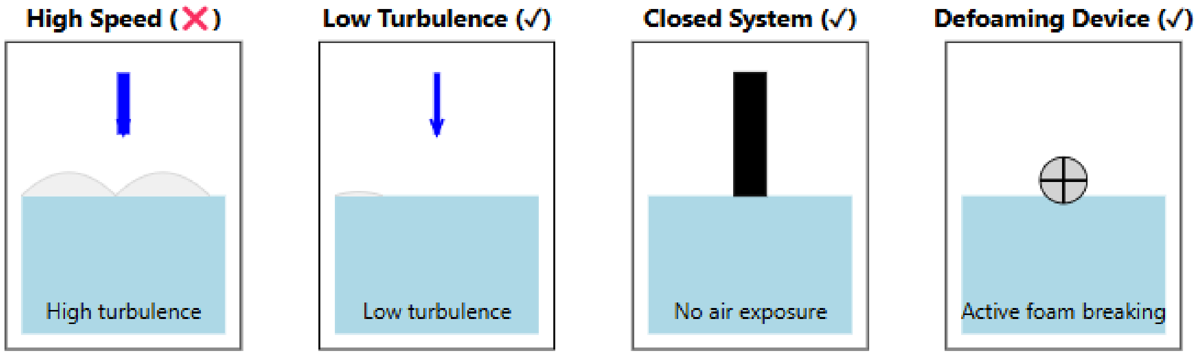
- **Explanation:**

Minimized product turbulence (b): Reducing turbulence during filling helps to limit air incorporation, thereby reducing foam.

Closed system filling (c): This method prevents air exposure to the liquid, significantly decreasing the likelihood of foam formation.

Defoaming device (d): Utilizing a defoaming device specifically targets foam reduction, making it an effective solution.

Foam Reduction Methods in Liquid Filling



Key Points:

1. Higher speed (✗) - Increases turbulence and foam formation
2. Minimized turbulence (✓) - Gentle filling reduces foam formation
3. Closed system (✓) - Prevents air incorporation during filling
4. Defoaming device (✓) - Actively breaks down foam formation

Answer Explanation:

Increasing speed of the filling line (Option A) is incorrect because higher speeds create more turbulence, leading to increased foam formation. All other options help reduce foaming during liquid filling operations.

The Reynolds number is defined as [GPAT-2016]

6.

(a) Measure of the ratio of inertial forces ρV2 / L to viscous forces μV/L2

(b) Measure of the ratio of inertial forces ρV2 / L to Non viscous forces (c) Measure of the ratio of viscous forces μV/L2 to inertial forces μV/L

(c) Measure of the ratio of viscous forces μV/ L2 to inertial forces ρV2 / L

(d) Measure of the ratio of non-viscous forces to inertial forces ρV2 / L

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(c) Measure of the ratio of viscous forces μV/ L2 to inertial forces ρV2 / L

(d) Measure of the ratio of non-viscous forces to inertial forces ρV2 / L

- **Explanation:**
- The Reynolds number (Re) is a dimensionless number used to predict the flow regime in fluid dynamics. It represents the ratio of inertial forces to viscous forces in a fluid.
- Newtonian Fluid Reynolds Number (Re) Formula

$$\mathbf{Re=(\rho VD)/\mu}$$

Where:

μ – fluid dynamic viscosity in kg/(m·s)

ρ – fluid density in kg/m^3

V – fluid velocity in m/s

D – pipe diameter in m

7. A large Reynolds number is indication of which type of flow [GPAT-2016]

(a) Smooth and stream line flow

(b) Laminar flow

(c) Steady flow

(d) Highly turbulent flow

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(a) Smooth and stream line flow

(b) Laminar flow

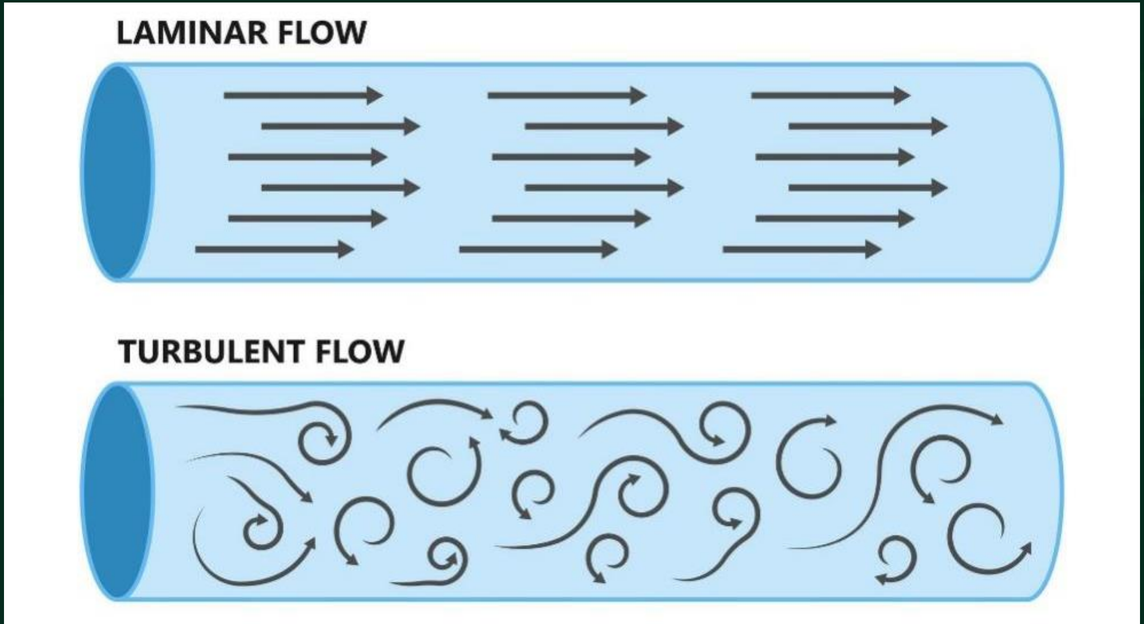
(c) Steady flow

(d) Highly turbulent flow

- **Explanation:**

A large Reynolds number indicates a flow with dominant inertial forces relative to viscous forces, which results in turbulence. In such cases, the flow becomes chaotic and has irregular patterns.

Typically, Reynolds numbers above 4000 suggest turbulent flow, while lower values (below 2000) indicate laminar, or smooth, streamlined flow.


LAMINAR FLOW
TURBULENT FLOW

8. Pitot tube measure using a manometer (GPAT-2013]

(a) Surface area

(b) Liquidity

(c) Velocity head

(d) Pressure head

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(a) Surface area

(b) Liquidity

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- **Explanation:**
  - A Pitot tube, when connected to a manometer, measures the velocity head of a flowing fluid.
  - The velocity head represents the kinetic energy per unit weight of the fluid, which can be determined by measuring the difference in height of the liquid columns in the manometer.
  - This difference corresponds to the dynamic pressure, from which the fluid's velocity can be calculated.

9. Precise control of flow is obtained by which one of the following [GPAT-2012]

(a) Needle valve

(b) Butterfly valve

(c) Gate valve

(d) Globe valve

9. Precise control of flow is obtained by which one of the following [GPAT-2012]

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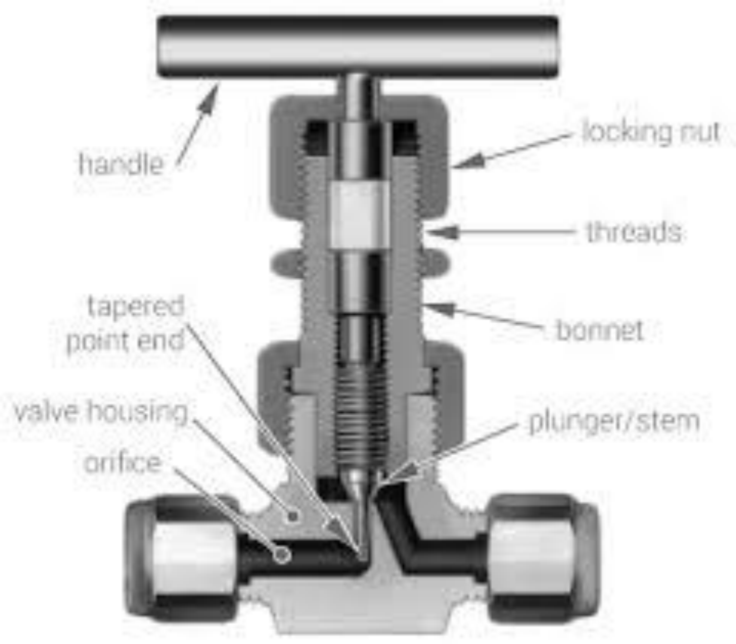
(c) Gate valve

(d) Globe valve

- **Explanation:**

A needle valve is specifically designed for precise flow control. It has a long, tapered, needle-like point at the end of the valve stem, which fits into a matching seat, allowing fine adjustments of flow rates. This design makes it ideal for applications where precise flow regulation is required, unlike other valves that are better suited for on/off control or less precise adjustments.


handle
locking nut
threads
tapered
point end
bonnet
valve housing
plunger/stem
orifice

10. The Reynolds number widely used to classify flow behaviour of fluid is the ratio of which one of the following [GPAT-2011]

(a) Inertial forces to gravitational forces

(b) Inertial forces to viscous forces

(c) Viscous forces to inertial forces

(d) Viscous forces to gravitational forces

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10. The Reynolds number widely used to classify flow behaviour of fluid is the ratio of which one of the following [GPAT-2011]

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- **Explanation:**
- The Reynolds number (Re) is a dimensionless number used to predict the flow regime in fluid dynamics. It represents the ratio of inertial forces to viscous forces in a fluid.
- Newtonian Fluid Reynolds Number (Re) Formula

$$Re=(\rho VD)/\mu$$

Where:

μ – fluid dynamic viscosity in kg/(m·s)

ρ – fluid density in kg/m^3

V – fluid velocity in m/s

D – pipe diameter in m


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11. The minimal effective flow rate of air in laminar flow hood should be not less than how many cubic feet per minute [GPAT-2011]

(a) 10

(b) 50

(c) 100

(d) 1000

11. The minimal effective flow rate of air in laminar flow hood should be not less than how many cubic feet per minute [GPAT-2011]

(a) 10

(b) 50

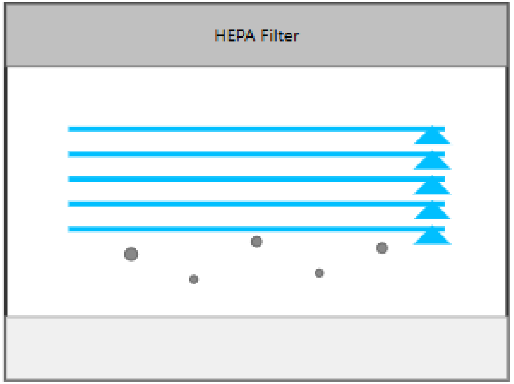
(c) 100

(d) 1000

- **Explanation:**

In a laminar flow hood, a minimum airflow rate of **100 cubic feet per minute (CFM)** is essential to maintain a sterile environment by providing unidirectional airflow that sweeps away contaminants. This rate helps ensure that particles do not settle within the workspace, maintaining a controlled, contaminant-free environment suitable for sensitive operations.

Laminar Flow Hood - Airflow Dynamics



Airflow Rate Dynamics

Minimum Airflow Rate: 100 CFM

100 CFM

Key Benefits:

- Continuous particle removal
- Unidirectional airflow
- Maintains sterile environment

Contamination Prevention

Particle Removal Mechanism

Contamination Control Methods:

- Uniform airflow direction
- Continuous air movement
- HEPA filtration
- Prevents particle settlement

Critical Parameters:

1. Minimum 100 CFM airflow
2. Unidirectional air movement
3. HEPA filtration

12. Which of the following is NOT a reciprocating pump [GPAT-2011]

(a) Plunger pump

(b) Diaphragm pump

(c) Gear pump

(d) Piston pump

12. Which of the following is NOT a reciprocating pump [GPAT-2011]

(a) Plunger pump

(b) Diaphragm pump

(c) Gear pump

(d) Piston pump

- **Explanation:**

- A gear pump is not a reciprocating pump; it is a type of rotary pump. Gear pumps operate by using the rotation of gears to move fluid, making them suitable for applications requiring steady, continuous flow.

- In contrast, reciprocating pumps, like plunger, diaphragm, and piston pumps, use a back-and-forth (reciprocating) motion to displace fluid, which creates a pulsating flow rather than a continuous one.

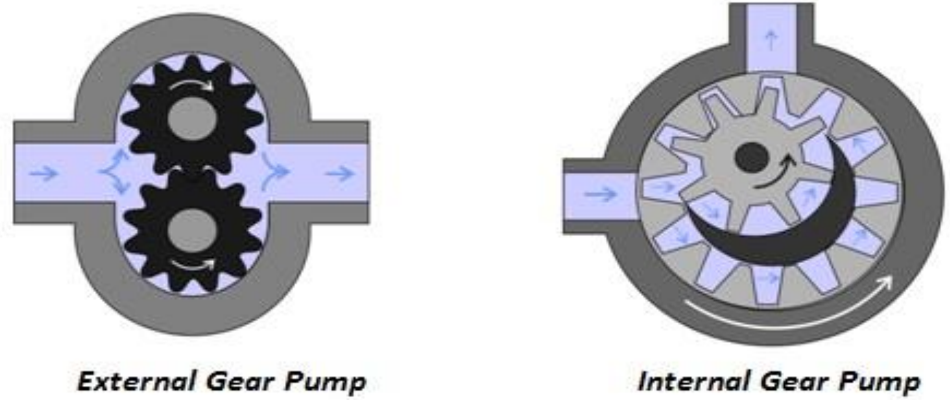


Figure 1. Gear pump designs (arrows indicate the direction of the pump and liquid)

13. Which of the following pumps is used in handling of corrosive liquids [GPAT-2011]

(a) Turbine pump

(b) Volute pump

(c) Air binding pump

(d) Peristaltic pump

13. Which of the following pumps is used in handling of corrosive liquids [GPAT-2011]

(a) Turbine pump

(b) Volute pump

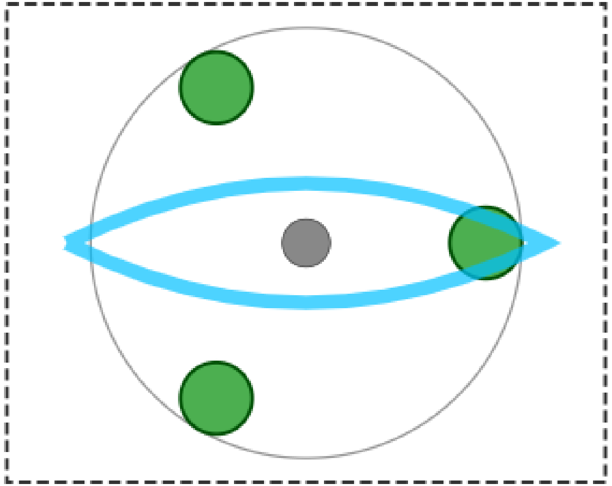
(c) Air binding pump

(d) Peristaltic pump

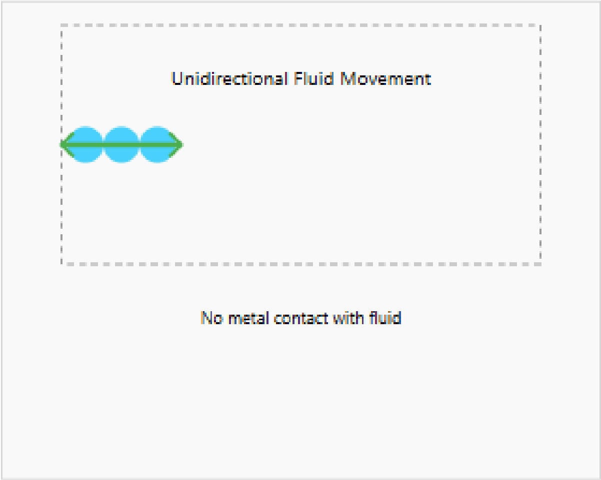
- **Explanation:**

Peristaltic pumps are well-suited for handling corrosive liquids because the fluid only contacts the flexible tubing inside the pump, preventing contact with any metal parts. This design reduces the risk of corrosion and contamination, making peristaltic pumps ideal for transferring aggressive chemicals and sensitive solutions. Other pump types, like turbine or volute pumps, may not be as effective for corrosive liquids, as they often have internal components that could corrode upon contact.

Peristaltic Pump - Comprehensive Mechanism Breakdown



Fluid Transfer Mechanism



14. When the principle of conservation of energy is applied to flow of fluids then resulting equation is known as

(a) Reynolds number

(b) Bernoulli's theorem

(c) Hagen-Poiseuille's equation

(d) Kick's theory

14. When the principle of conservation of energy is applied to flow of fluids then resulting equation is known as

(a) Reynolds number

(b) Bernoulli's theorem

(c) Hagen-Poiseuille's equation

(d) Kick's theory

- **Explanation**:

- Bernoulli's theorem: It is derived from the principle of conservation of energy applied to fluid flow. It states that in a streamline flow, the total mechanical energy along a streamline (comprising kinetic energy, potential energy, and pressure energy) remains constant. The equation expresses the relationship between pressure, velocity, and height of a fluid, demonstrating how energy is conserved in a fluid system.

- Reynolds Number: This is a dimensionless number that helps predict flow patterns in different fluid flow situations but does not specifically represent energy conservation.

- Hagen-Poiseuille's Equation: This equation describes laminar flow in cylindrical pipes and relates to the pressure drop over a length of the pipe, but it does not encapsulate the overall energy conservation in fluid dynamics.

- Kick's Theory: This relates to the size reduction process in materials and is not applicable to fluid dynamics in the context of energy conservation.

15. Bernoulli's theorem state that the pressure energy, kinetic energy, datum energy at any point of the fluids is

(a) High

(b) Constant

(c) Low

(d) Moderate

15. Bernoulli's theorem state that the pressure energy, kinetic energy, datum energy at any point of the fluids is

(a) High

(b) Constant

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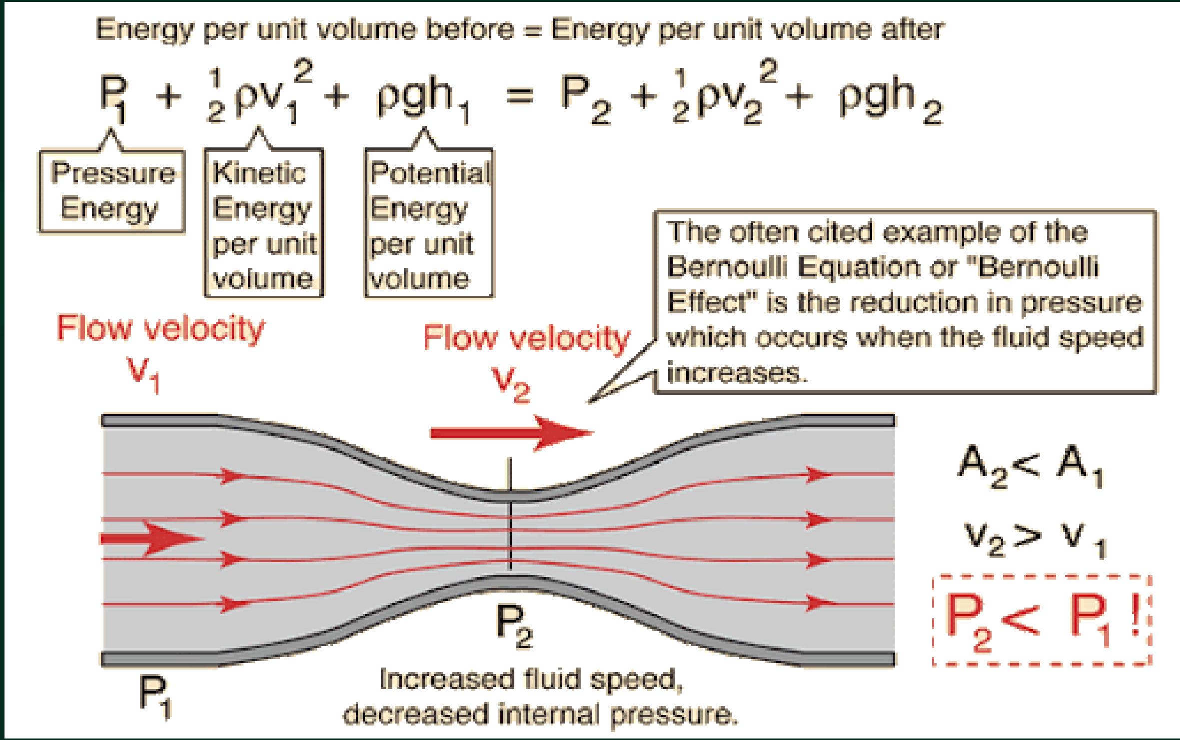
(d) Moderate

- **Explanation:**

Bernoulli's theorem states that the total mechanical energy along a streamline is constant. This total energy includes pressure energy, kinetic energy, and potential energy (datum energy). Therefore, at any point in a fluid flow, the sum of these forms of energy remains constant, assuming the flow is steady, incompressible, and frictionless. This principle helps analyze fluid behavior in various applications, such as pipe flow and air flow performance.


Energy per unit volume before = Energy per unit volume after
$P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$
Pressure Energy
Kinetic Energy per unit volume
Potential Energy per unit volume
The often cited example of the Bernoulli Equation or "Bernoulli Effect" is the reduction in pressure which occurs when the fluid speed increases.
Flow velocity v_1
Flow velocity v_2
$A_2 < A_1$
$v_2 > v_1$
$P_2 < P_1$!
P_2
P_1
Increased fluid speed, decreased internal pressure.

16. The energy possess by the body virtue of its motion is known as

(a) Kinetic energy

(b) Potential energy

(c) Pressure energy

(d) Solar energy

16. The energy possess by the body virtue of its motion is known as

(a) Kinetic energy

(b) Potential energy

(c) Pressure energy

(d) Solar energy

Explanation:

Kinetic energy is the energy that a body possesses due to its motion. This form of energy is crucial in fluid dynamics, as it describes the energy associated with the movement of fluid particles.

- **Potential energy** refers to the energy stored in an object due to its position or state, such as an object's height above the ground.
- **Pressure energy** is the energy stored in a fluid due to its pressure, contributing to the work done by the fluid.
- **Solar energy** is the energy derived from the sun's radiation, unrelated to motion.

kinetic energy

$$\boxed{K = \frac{1}{2}mv^2}$$

K = kinetic energy
m = mass
v = velocity

17. Which of the following is the type of manometer

(a) Rotameter

(b) Acute manometer

(c) Differential manometer

(d) Thermometer

17. Which of the following is the type of manometer

(a) Rotameter

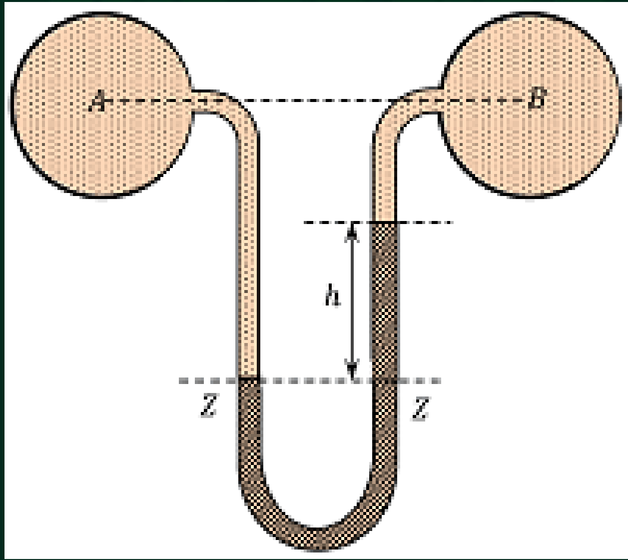
(b) Acute manometer

(c) Differential manometer

(d) Thermometer

- **Explanation:**
- A differential manometer is specifically designed to measure the difference in pressure between two points in a fluid system. It typically consists of a U-shaped tube filled with liquid, where the heights of the liquid columns indicate the pressure difference. This type of manometer is commonly used in various applications, including hydraulics and fluid mechanics.
- **Rotameter:** This is a device used to measure the flow rate of liquids and gases, not a type of manometer.

- **Acute manometer:** This term is not commonly recognized in fluid dynamics or metrology, making it an incorrect option.
- **Thermometer:** This instrument is used to measure temperature, not pressure.



18. The Property of fluid they describe internal resistance it is known as

(a) Internal Energy

(b) Shock loss

(c) Resistance

(d) Frictional loss

18. The Property of fluid they describe internal resistance it is known as

(a) Internal Energy

(b) Shock loss

(c) Resistance

(d) Frictional loss

- **Explanation:**
- Frictional loss refers to the internal resistance of a fluid to flow, which occurs due to the viscosity of the fluid and the interactions between fluid molecules and the surfaces they flow past. This resistance causes energy losses in the form of heat as the fluid flows through pipes, ducts, or other conduits.

Frictional Loss in Fluid Flow

Viscosity Creates Internal Resistance and Energy Loss

19. The frictional resistance for fluid in the motion is

(a) Proportional to the velocity in laminar flow and to the square of the velocity in turbulent flow

(b) Proportional to the square of the velocity in laminar flow and to the velocity in turbulent flow

(c) Proportional to the velocity in both laminar flow and turbulent flow

(d) Proportional to the square of the velocity in both laminar & turbulent flow

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(c) Proportional to the velocity in both laminar flow and turbulent flow

(d) Proportional to the square of the velocity in both laminar & turbulent flow

- **Explanation:**
- **Laminar Flow**: In laminar flow, the frictional resistance (or shear stress) is proportional to the velocity. This relationship can be described by the Hagen-Poiseuille equation, where the pressure drop is directly related to the flow rate (and therefore velocity).
- **Turbulent Flow**: In turbulent flow, the frictional resistance is generally proportional to the square of the velocity. This is expressed through the Darcy-Weisbach equation, which shows that as flow velocity increases, the energy loss due to friction increases with the square of the velocity.

20. Orifice meter is part of

(a) Flow of fluid

(b) Size reduction

(c) Size separation

(d) Venturi meter

20. Orifice meter is part of

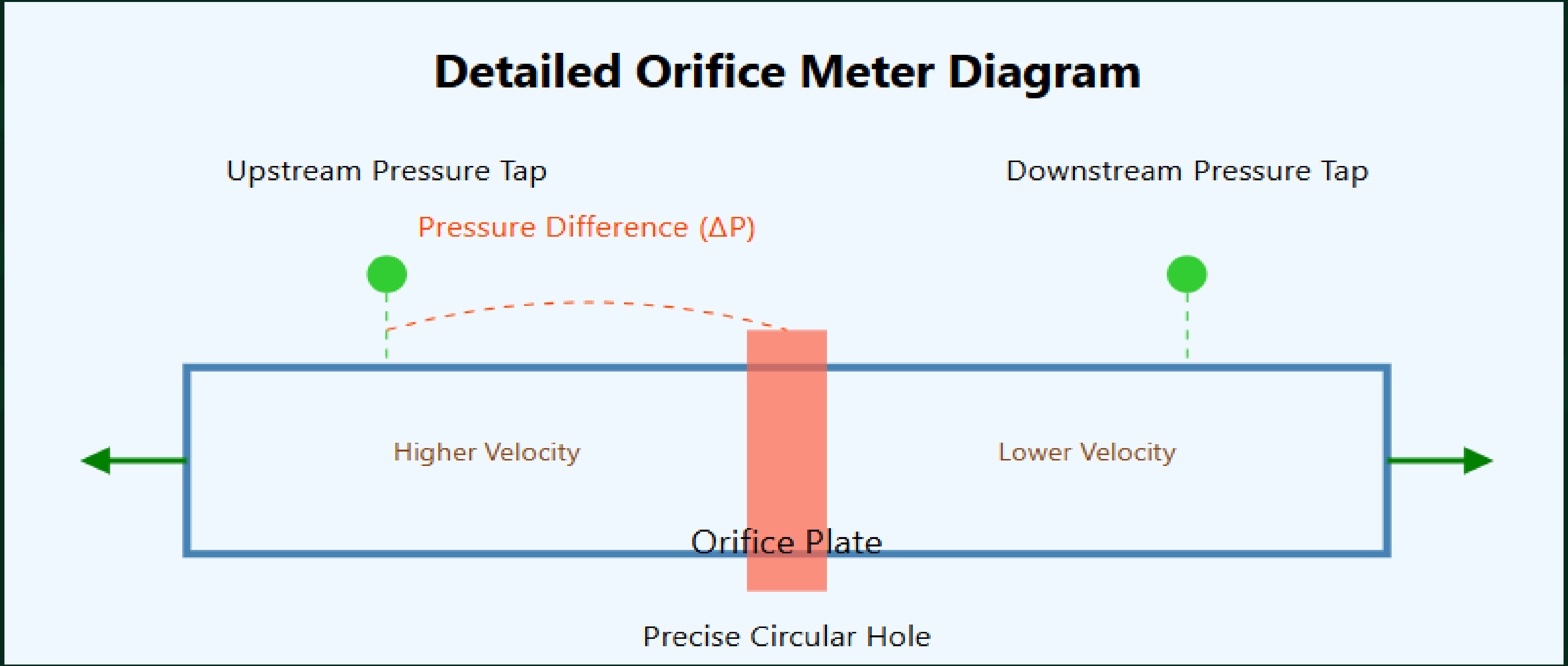
(a) Flow of fluid

(b) Size reduction

(c) Size separation

(d) Venturi meter

- **Explanation:**
- An orifice meter is a device used to measure the flow rate of a fluid in a pipeline. It works by creating a pressure differential across a known restriction (the orifice), allowing the flow rate to be calculated based on the difference in pressure before and after the orifice. This device is commonly used in various fluid flow applications, including water supply, chemical processing, and HVAC systems.


Detailed Orifice Meter Diagram
Upstream Pressure Tap
Downstream Pressure Tap
Pressure Difference (ΔP)
Higher Velocity
Lower Velocity
Orifice Plate
Precise Circular Hole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21. In drying process, which of the following parameters is same as the adiabatic saturation temperature: [GPAT-2024]

(a) Absolute humidity

(b) Dew point

(c) Wet bulb temperature

(d) Relative humidity

21. In drying process, which of the following parameters is same as the adiabatic saturation temperature: [GPAT-2024]

(a) Absolute humidity

(b) Dew point

(c) Wet bulb temperature

(d) Relative humidity

- **Explanation:**

a) Absolute Humidity: This is the measure of the actual water vapor content in the air, typically expressed in grams of water per cubic meter of air. Absolute humidity doesn't relate directly to adiabatic saturation temperature, as it represents the total water content in the air rather than a temperature-related property.

(b) Dew Point: The dew point is the temperature at which air becomes saturated and water vapor begins to condense. While both dew point and wet bulb temperature are indicators of humidity, the dew point does not correspond to the adiabatic saturation temperature.

(c) **Wet Bulb Temperature**: The wet bulb temperature is the temperature measured when air passes over a water-saturated surface, causing some of the water to evaporate. This process is adiabatic (no heat exchange with the surroundings), and the temperature achieved represents the adiabatic saturation temperature. Thus, wet bulb temperature is equivalent to the adiabatic saturation temperature, making it the correct answer.

(d) Relative Humidity: This is the ratio of the current amount of water vapor in the air to the maximum amount of water vapor it can hold at that temperature. While relative humidity provides information about moisture content in relation to saturation, it doesn't represent a temperature measure like the adiabatic saturation temperature.

22. The most efficient heat exchange between the particles and flowing air occurs in the [GPAT-2023 SHIFT I]

(a) Tray dryer

(b) Vacuum Dryer

(c) Fluidized bed dryer

(d) Rotary dryer

22. **The most efficient heat exchange between the particles and flowing air occurs in the [GPAT-2023 SHIFT I]**

(a) Tray dryer

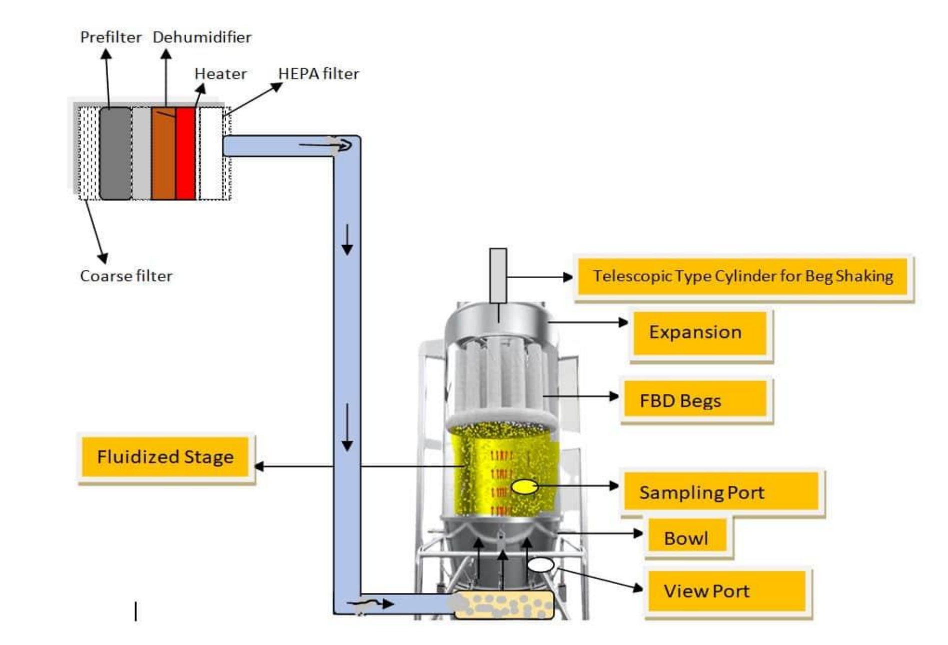
(b) Vacuum Dryer

(c) Fluidized bed dryer

(d) Rotary dryer

- **Explanation:**

In a fluidized bed dryer, particles are suspended and kept in constant motion by a stream of air, allowing for efficient heat transfer between the hot air and the particles. This setup maximizes the contact area between the drying air and the particles, resulting in highly efficient heat exchange.


Prefilter
Dehumidifier
Heater
HEPA filter
Coarse filter
Telescopic Type Cylinder for Beg Shaking
Expansion
FBD Begs
Fluidized Stage
Sampling Port
Bowl
View Port

23. Which of the following DRYERS is a "static bed dryer" [GPAT-2022]

(a) Freeze dryer

(b) Fluid bed dryer

(c) Spray dryer

(d) Flash dryer

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(a) Freeze dryer

(b) Fluid bed dryer

(c) Spray dryer

(d) Flash dryer

- **Explanation:**

(a) Freeze Dryer: In a freeze dryer, the material is placed on shelves and remains stationary while the water is removed by sublimation under vacuum. Since there is no movement of the material, this is considered a static bed dryer.

(b) Fluid Bed Dryer: In a fluid bed dryer, the material is fluidized by an upward stream of air, causing the particles to move and float. This is a dynamic process, so it is not a static bed dryer.

(c) Spray Dryer: A spray dryer atomizes the liquid into fine droplets, which are then dried in a hot air stream as they fall. This process involves continuous movement of the droplets, so it is not a static bed dryer.

(d) Flash Dryer: In a flash dryer, materials are rapidly dried by passing them through a stream of hot gas. The particles are suspended and transported by the air, so this is also a dynamic process, not a static bed.

24. **In which of the following techniques the sample is kept below triple point [GPAT-2016]**

(a) Lyophilization

(b) Spray drying

(c) Spray congealing

(d) Centrifugation

24. In which of the following techniques the sample is kept below triple point [GPAT-2016]

(a) Lyophilization

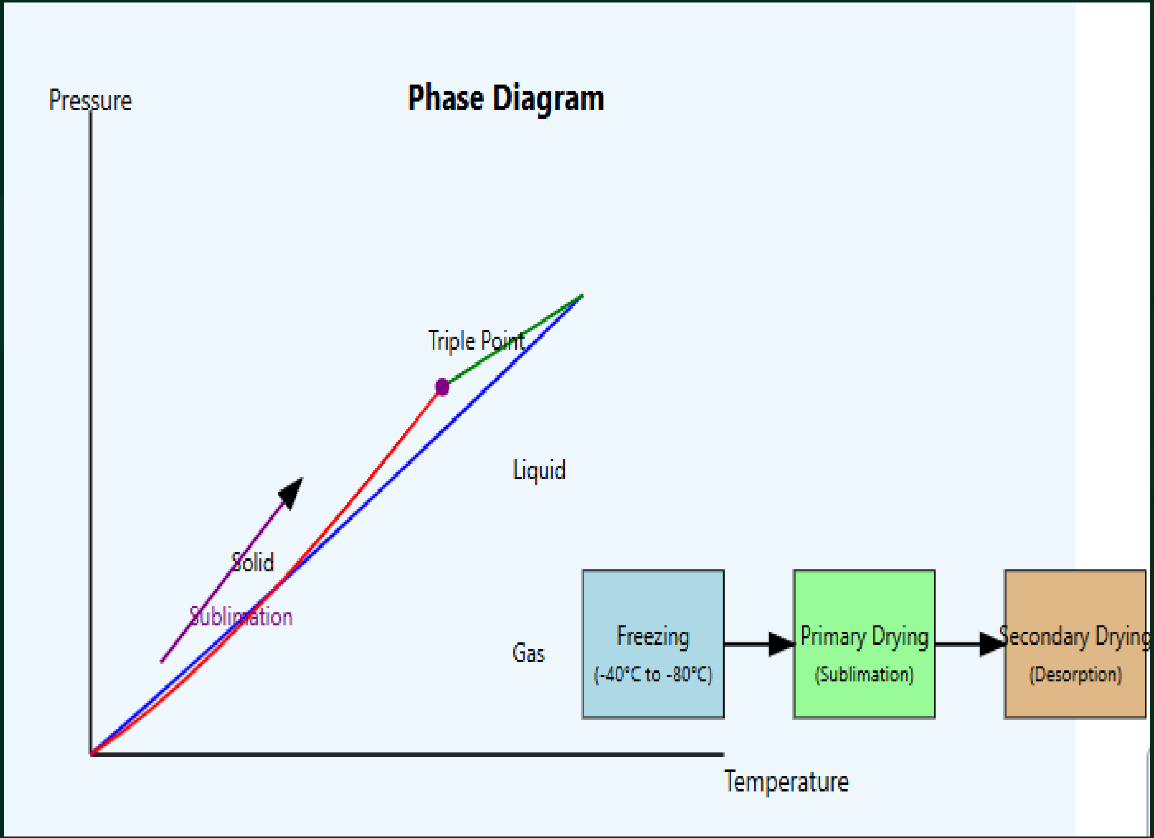
(b) Spray drying

(c) Spray congealing

(d) Centrifugation

- **Explanation:**

In lyophilization (also known as freeze drying), the sample is kept below its triple point to ensure that water transitions directly from solid to vapor (sublimation) without passing through the liquid phase. This method is used to preserve heat-sensitive materials, as it prevents degradation due to high temperatures and helps retain the sample's structure.


Phase Diagram
Pressure
Temperature
Triple Point
Liquid
Solid
Sublimation
Gas
Freezing
(-40°C to -80°C)
Primary Drying
(Sublimation)
Secondary Drying
(Desorption)

25.

Read the following statements about lyophilization [GPAT-2012]

[P] Lyophilization cannot be done in final containers like multiple dose containers

[Q] Lyophilized product needs special methods for reconstitution

[R] Lyophilization causes protein denaturation in tissues

[S] Lyophilization is suitable for drying the thermolabile products

25. Choose the correct combination of statements

(a) P is true and Q, R & S are false

(b) Q is true and P, R & S are false

(c) R is true and P, Q & S are false

(d) S is true and P, Q & R are false

25. Choose the correct combination of statements

(a) P is true and Q, R & S are false

(b) Q is true and P, R & S are false

(c) R is true and P, Q & S are false

(d) S is true and P, Q & R are false

- **Explanation:**

[P]Lyophilization cannot be done in final containers like multiple dose containers:

This statement is **false**. Lyophilization can indeed be performed in final containers, including multiple-dose containers, which is commonly done in the pharmaceutical industry to facilitate sterile packaging.

[Q]Lyophilized product needs special methods for reconstitution:

This statement is **false**. Lyophilized products do not necessarily require "special" methods for reconstitution; they generally just need the addition of a suitable solvent (often sterile water or a diluent), which is a standard and straightforward process.

[R]Lyophilization causes protein denaturation in tissues:

This statement is **false**. Lyophilization is actually used to preserve the integrity of proteins and other thermolabile substances by minimizing heat exposure. It typically prevents protein denaturation rather than causing it.

[S]Lyophilization is suitable for drying thermolabile products:

This statement is **true**. Lyophilization is specifically designed for thermolabile (heat-sensitive) products, as it operates at low temperatures, allowing the material to be dried without significant heat exposure, thus preserving its stability.

26. Which one of the following drying methods is commonly used in Pharma industry for drying of soft shell capsules [GPAT-2011]

(a) Truck drying

(b) Fluid bed drying

(c) Vacuum drying

(d) Microwave drying

26. Which one of the following drying methods is commonly used in Pharma industry for drying of soft shell capsules [GPAT-2011]

(a) Truck drying

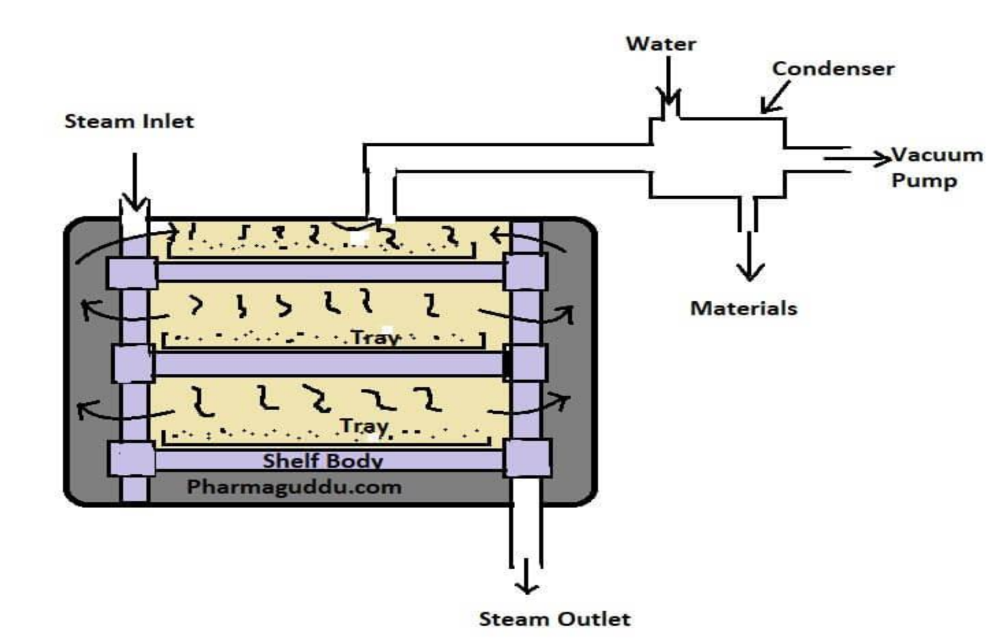
(b) Fluid bed drying

(c) Vacuum drying

(d) Microwave drying

- **Explanation:**

Vacuum drying is commonly used in the pharmaceutical industry for drying soft shell capsules. This method applies a vacuum to lower the pressure, allowing moisture to evaporate at a lower temperature. This helps preserve the quality of the gelatine shell and prevents deformation, which is essential for soft gelatin capsules that are sensitive to heat.


Water
Condenser
Steam Inlet
Vacuum Pump
Materials
Tray
Tray
Shelf Body
Pharmaguddu.com
Steam Outlet

27. Which one of the following is the commonly used bulking agent in the formulation of freeze dried low dose drug products [GPAT-2010]

(a) Sodium chloride

(b) Mannitol

(c) Starch

(d) HPMC

27. Which one of the following is the commonly used bulking agent in the formulation of freeze dried low dose drug products [GPAT-2010]

(a) Sodium chloride

(b) Mannitol

(c) Starch

(d) HPMC

- **Explanation:**
- Mannitol is commonly used as a bulking agent in the formulation of freeze-dried (lyophilized) low-dose drug products. It provides bulk to the formulation, helping to form a stable, porous matrix upon drying. Mannitol is highly preferred because it crystallizes during freeze drying, resulting in a strong, aesthetically pleasing structure that is stable and easy to reconstitute.

28.

Match the following Industrial dryers with Pharmaceutical material dried IGATE-2008]

Group I	Group II
Industrial dryers	Pharmaceutical material dried
1. Drum dryer	[P] Antibiotic solution
2. Fluidized bed dryer	[Q] Tablet granules
3. Spray dryer	[R] Gelatin
4. Freeze dryer	[S] Suspension of kaolin

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

28.

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4. Freeze dryer	[S] Suspension of kaolin

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

- **Explanation:**

Industrial Dryer	Pharmaceutical Material Dried	Description
1. Drum Dryer	Suspension of Kaolin (S)	Efficiently dries slurries by spreading them as thin films on heated drums.
2. Fluidized Bed Dryer	Tablet Granules (Q)	Provides uniform drying of granules by fluidizing them in hot air, essential for tablet production.
3. Spray Dryer	Gelatin (R)	Atomizes liquid solutions into fine droplets, quickly

Industrial Dryer	Pharmaceutical Material Dried	Description
3. Spray Dryer	Gelatin (R)	Atomizes liquid solutions into fine droplets, quickly drying to produce gelatin powder.
4. Freeze Dryer	Antibiotic Solution (P)	Uses lyophilization to preserve heat-sensitive drugs, creating stable powders for reconstitution.

29. In the preparation of small pox vaccine, the drying process used is [GATE-2005]

(a) Spray drying

(b) Vacuum drying

(c) Drum drying

(d) Freeze drying

29. In the preparation of small pox vaccine, the drying process used is (GATE-2005]

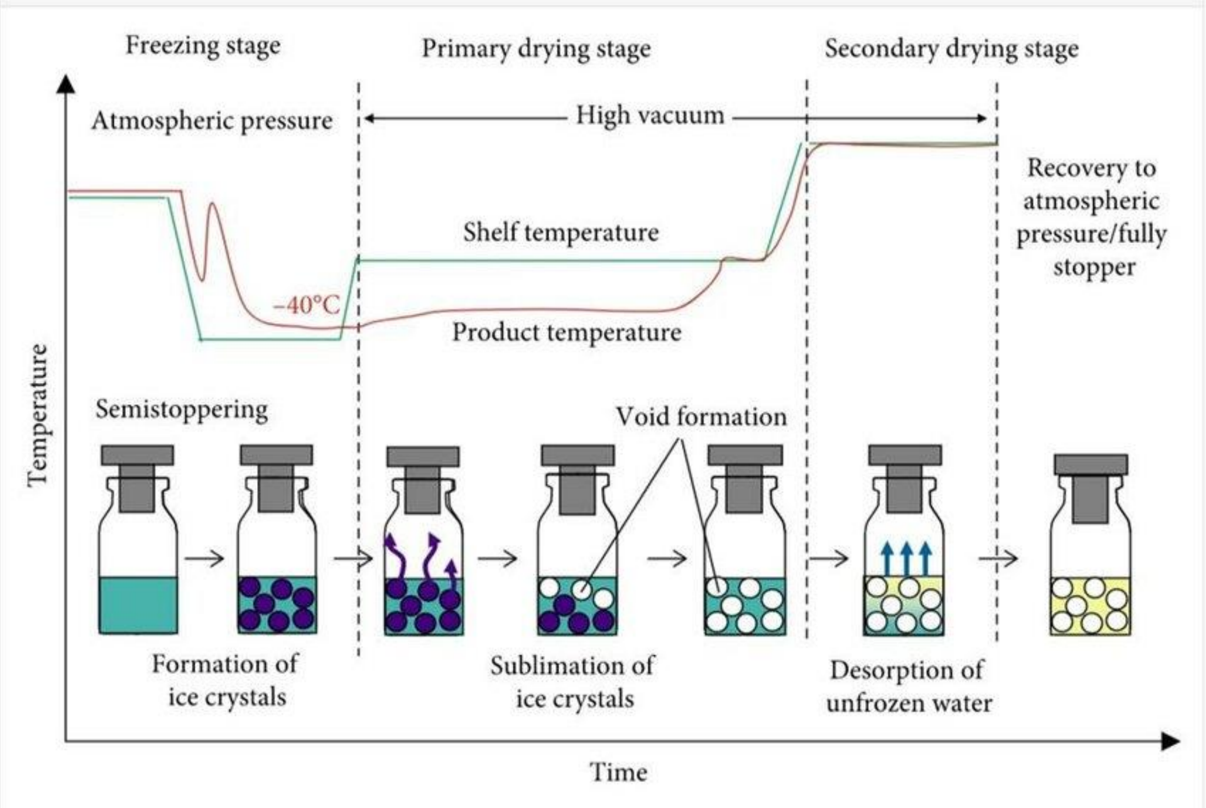
(a) Spray drying

(b) Vacuum drying

(c) Drum drying

(d) Freeze drying

- **Explanation:**
- Freeze Drying (Lyophilization):
- Process: Involves freezing the product and then reducing the pressure to allow frozen water to sublimate directly into vapor.
- Application in Smallpox Vaccine: This method is ideal for preserving the viability and potency of live viruses. The process allows the smallpox vaccine to be stored for long periods without losing its effectiveness.
- **Advantages:** It maintains the structural integrity of sensitive biological materials and results in a stable product that can be easily reconstituted.



Freezing stage
Primary drying stage
Secondary drying stage
Atmospheric pressure
High vacuum
Recovery to atmospheric pressure/fully stopper
Shelf temperature
−40°C
Product temperature
Temperature
Semistoppering
Void formation
Formation of ice crystals
Sublimation of ice crystals
Desorption of unfrozen water
Time

PHARMACY INDIA

30. For drying blood plasma the following technique is used [GATE-1989]

(a) Spray drying

(b) Freeze drying

(c) Vacuum drying

(d) Fluid bed drying

30. For drying blood plasma the following technique is used [GATE-1989]

(a) Spray drying

(b) Freeze drying

(c) Vacuum drying

(d) Fluid bed drying

- **Explanation:**

Freeze Drying (Lyophilization):

- **Process**: Blood plasma is frozen, then placed under vacuum to allow frozen water to sublimate.
- **Advantages**: Preserves the integrity and biological activity of plasma components, making it suitable for long-term storage.

Spray Drying: Not suitable for blood plasma due to high temperatures that can denature proteins.

Vacuum Drying: Less effective for biological materials; may risk damage.

Fluid Bed Drying: Not applicable for liquids like blood plasma.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31. Which one of the following dryers is known as lyophiliser

(a) Fluidised bed dryer

(b) Freeze dryer

(c) Spray dryer

(d) Vacuum dryer

31. Which one of the following dryers is known as lyophiliser

(a) Fluidised bed dryer

(b) Freeze dryer

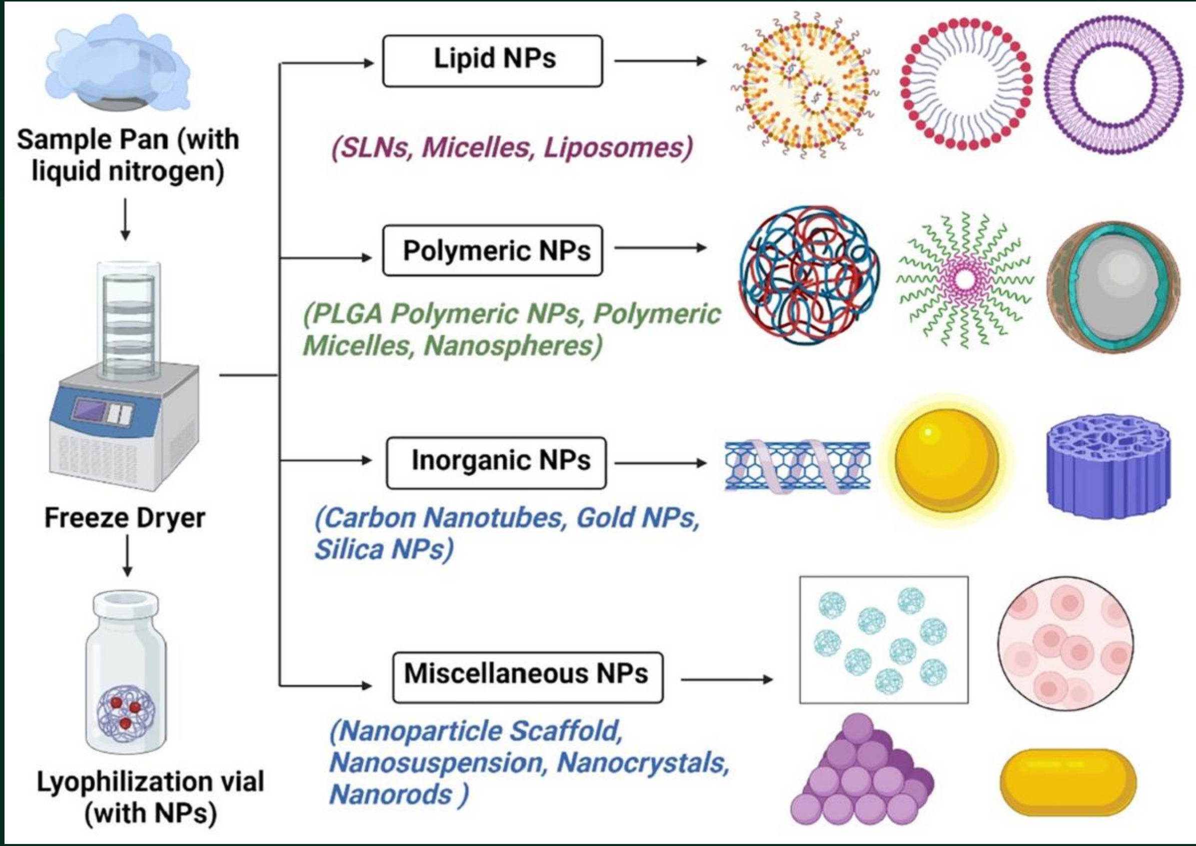
(c) Spray dryer

(d) Vacuum dryer

- **Explanation:**

  Freeze Dryer (Lyophiliser):

  Function: It is specifically designed to freeze a product and then reduce the surrounding pressure to allow the frozen water to sublimate. This method effectively preserves the structure and biological activity of sensitive materials, making it ideal for pharmaceuticals and biological products.


Sample Pan (with liquid nitrogen)
Freeze Dryer
Lyophilization vial (with NPs)
Lipid NPs
(SLNs, Micelles, Liposomes)
Polymeric NPs
(PLGA Polymeric NPs, Polymeric Micelles, Nanospheres)
Inorganic NPs
(Carbon Nanotubes, Gold NPs, Silica NPs)
Miscellaneous NPs
(Nanoparticle Scaffold, Nanosuspension, Nanocrystals, Nanorods)

32. Talc has equilibrium moisture content (EMC) of practically

(a) High

(b) One

(c) Variable

(d) Zero

32. Talc has equilibrium moisture content (EMC) of practically

(a) High

(b) One

(c) Variable

(d) Zero

- **Explanation:**

  Talc: Talc is a hydrophobic material that does not absorb moisture from the environment. Therefore, its equilibrium moisture content (EMC) is effectively zero, meaning it does not retain moisture under typical storage conditions.

33. Which equipment is used for drying of methyl cellulose

(a) Drum dryer

(b) Spray dryer

(c) Tray dryer

(d) Vacuum dryer

33. Which equipment is used for drying of methyl cellulose

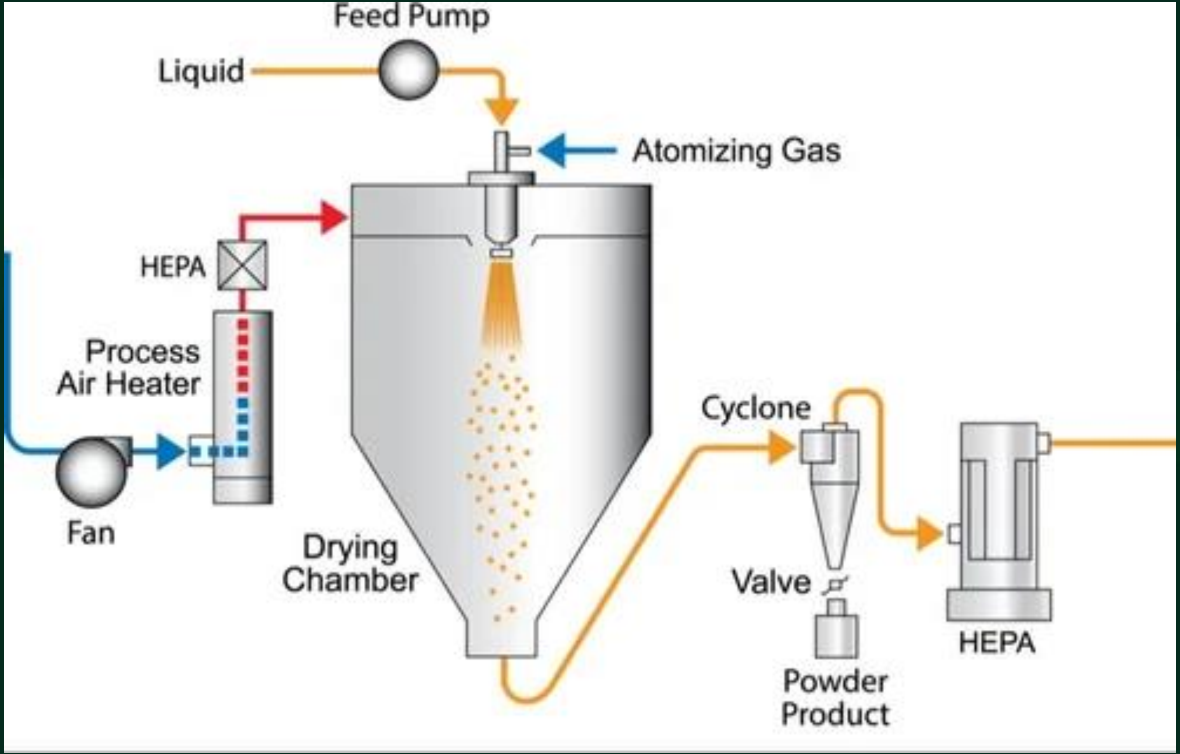
(a) Drum dryer

(b) Spray dryer

(c) Tray dryer

(d) Vacuum dryer

- **Explanation:**
- Spray Dryer: This equipment is commonly used for drying methyl cellulose due to its ability to quickly remove moisture from solutions or suspensions by atomizing the material into fine droplets and exposing them to a hot air stream. This method effectively retains the properties of methyl cellulose while producing a fine powder.



Feed Pump
Liquid
Atomizing Gas
HEPA
Process Air Heater
Fan
Drying Chamber
Cyclone
Valve
Powder Product
HEPA

34. Migration of salts and solutes does NOT occur in one of the following equipment for drying

(a) Freeze dryer

(b) Spray dryer

(c) Tray dryer

(d) Vacuum dryer

34. Migration of salts and solutes does NOT occur in one of the following equipment for drying

(a) Freeze dryer

(b) Spray dryer

(c) Tray dryer

(d) Vacuum dryer

- **Explanation:**

Freeze Dryer (Lyophilizer): In this equipment, the drying process involves freezing the material first, then applying a vacuum to allow sublimation of ice into vapor. This method minimizes migration of salts and solutes, preserving the structure and concentration of the original solution, making it ideal for sensitive products.

(b) Spray Dryer: Involves atomizing liquid into fine droplets; salts and solutes can migrate during the drying process due to rapid evaporation.

(c) Tray Dryer: Drying occurs in trays at higher temperatures, which can lead to solute migration.

(d) Vacuum Dryer: Although it operates under reduced pressure, it can still result in some migration of salts and solutes during the drying process.

35. Which one of the following types of product is having equilibrium moisture content (EMC) of practically zero

(a) Non-porous and insoluble

(b) Non-porous and soluble

(c) Porous and insoluble

(d) Porous and soluble

35. Which one of the following types of product is having equilibrium moisture content (EMC) of practically zero

(a) Non-porous and insoluble

(b) Non-porous and soluble

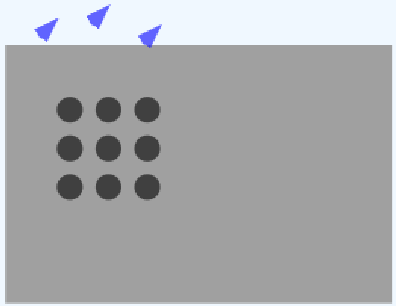
(c) Porous and insoluble

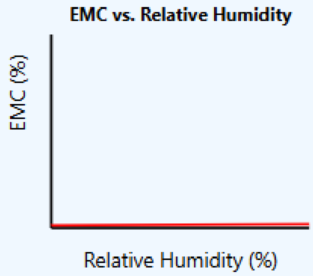
(d) Porous and soluble

- **Explanation:**

Non-porous and Insoluble Products: These materials, which include certain plastics and waxes, do not allow moisture to penetrate due to their dense structure and lack of solubility. Consequently, their equilibrium moisture content (EMC) is practically zero, indicating minimal interaction with moisture from the environment.

Non-porous and Insoluble Materials





Characteristics:

- Dense molecular structure
- No moisture penetration
- Zero EMC
- Water repellent surface

36. Drying process takes long time in one of the following equipment

(a) Drum dryer

(b) Fluidized bed dryer

(c) Spray dryer

(d) Tray dryer

36. Drying process takes long time in one of the following equipment

(a) Drum dryer

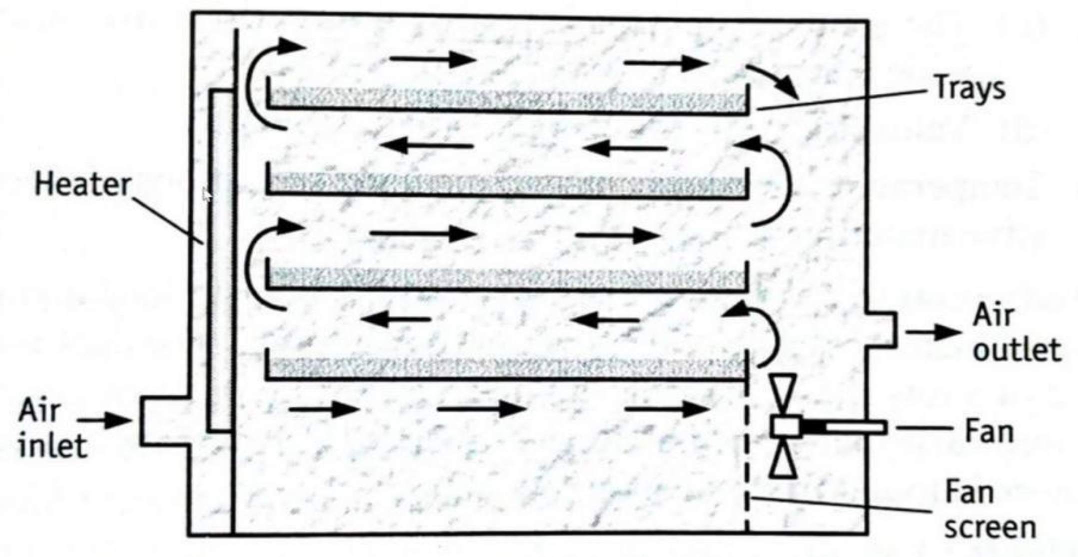
(b) Fluidized bed dryer

(c) Spray dryer

(d) Tray dryer

- **Explanation:**

  Tray Dryer: This equipment typically has longer drying times because it relies on convection and conduction to remove moisture. The product is spread out in trays, and drying occurs slowly as air circulates around the trays, making it lessefficient compared to other drying methods.


Trays
Heater
Air
outlet
Air
inlet
Fan
Fan
screen

37. Thermolabile substances can NOT be dried using one the following equipment

(a) Drum dryer

(b) Lyophilizer

(c) Spray dryer

(d) Tray dryer

37. **Thermolabile substances can NOT be dried using one the following equipment**

(a) Drum dryer

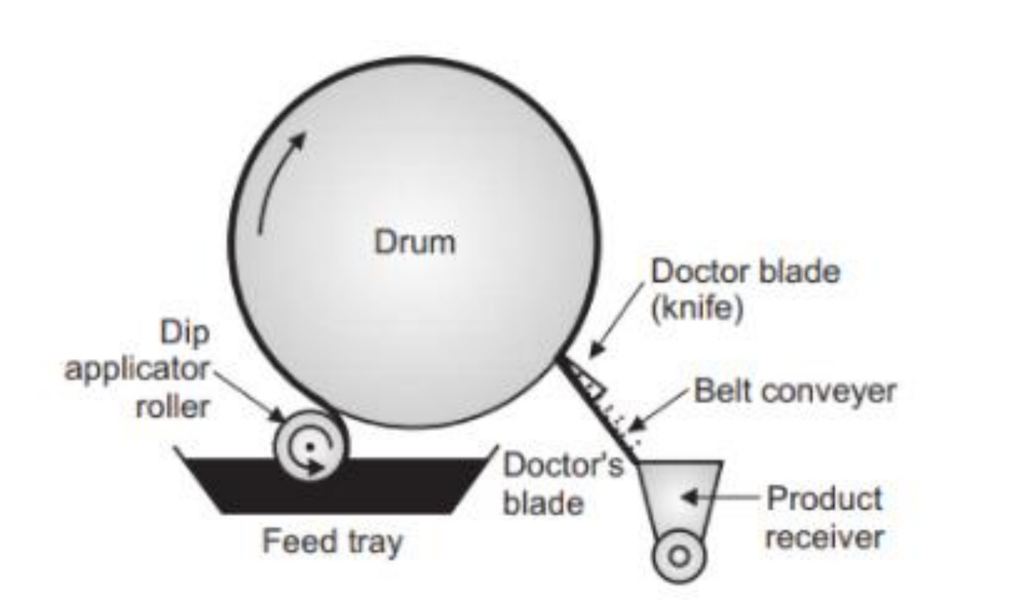
(b) Lyophilizer

(c) Spray dryer

(d) Tray dryer

- **Explanation:**

Drum Dryer: This equipment operates at relatively high temperatures, which can be detrimental to thermolabile substances (heat-sensitive materials). The high heat may cause degradation or loss of activity in these substances, making drum dryers unsuitable for their drying.


Drum
Doctor blade
(knife)
Dip
applicator
roller
Belt conveyer
Doctor's
blade
Product
receiver
Feed tray

38. **Drying is different from evaporation in one of the following ways**

(a) Liquid removed is low

(b) Temperature applied is high

(c) Quantity of product formed is high

(d) Time required is less

38. Drying is different from evaporation in one of the following ways

(a) Liquid removed is low

(b) Temperature applied is high

(c) Quantity of product formed is high

(d) Time required is less

- **Explanation:**

One of the distinctions is that **drying generally requires more time than evaporation. Evaporation can occur quickly**, especially at higher temperatures or under low-pressure conditions, while drying, particularly in industrial applications, often takes longer as it involves removing moisture from solid materials.

While **drying may use higher temperatures, evaporation can also occur at lower temperatures**, making this option ambiguous.

39. Which condition is highly critical for drying operation

(a) Moisture

(b) Pressure

(c) Temperature

(d) Volume

39. Which condition is highly critical for drying operation

(a) Moisture

(b) Pressure

(c) Temperature

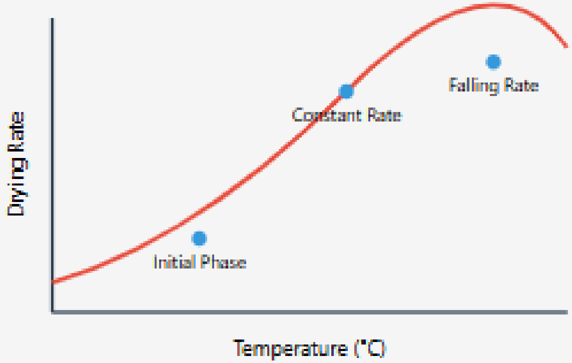
(d) Volume

- **Explanation:**

Temperature: This is a highly critical condition in drying operations. The temperature directly affects the rate of moisture removal; higher temperatures generally increase the evaporation rate, thereby speeding up the drying process. However, care must be taken to avoid damaging thermolabile substances.

Temperature: The Critical Parameter in Drying Operations

Drying Rate vs Temperature



Temperature Effects

- Controls Moisture Evaporation Rate
- Affects Product Quality
- Determines Energy Efficiency

Critical Parameter Comparison

TEMPERATURE

Primary Control Parameter

40. Eutectic point is an important factor for one of the following drying processes

(a) Drum drying

(b) Fluidized bed drying

(c) Freeze drying

(d) Tray drying

40. Eutectic point is an important factor for one of the following drying processes

(a) Drum drying

(b) Fluidized bed drying

(c) Freeze drying

(d) Tray drying

- **Explanation:**

Freeze Drying (Lyophilization): The eutectic point is critical in freeze drying, as it refers to the specific temperature and composition at which the mixture of solutes and solvents freezes into a solid phase. Understanding the eutectic point is essential to optimize the drying process, as it helps in controlling the sublimation of ice and preserving the structure of thermolabile substances during drying.

(a) Drum Drying: This method primarily relies on heat transfer and does not involve a eutectic point.

(b) Fluidized Bed Drying: Like drum drying, fluidized bed drying focuses on airflow and moisture removal without the need for eutectic considerations.

(d) Tray Drying: This method involves conventional drying at ambient or elevated temperatures, where eutectic points are not a significant factor.

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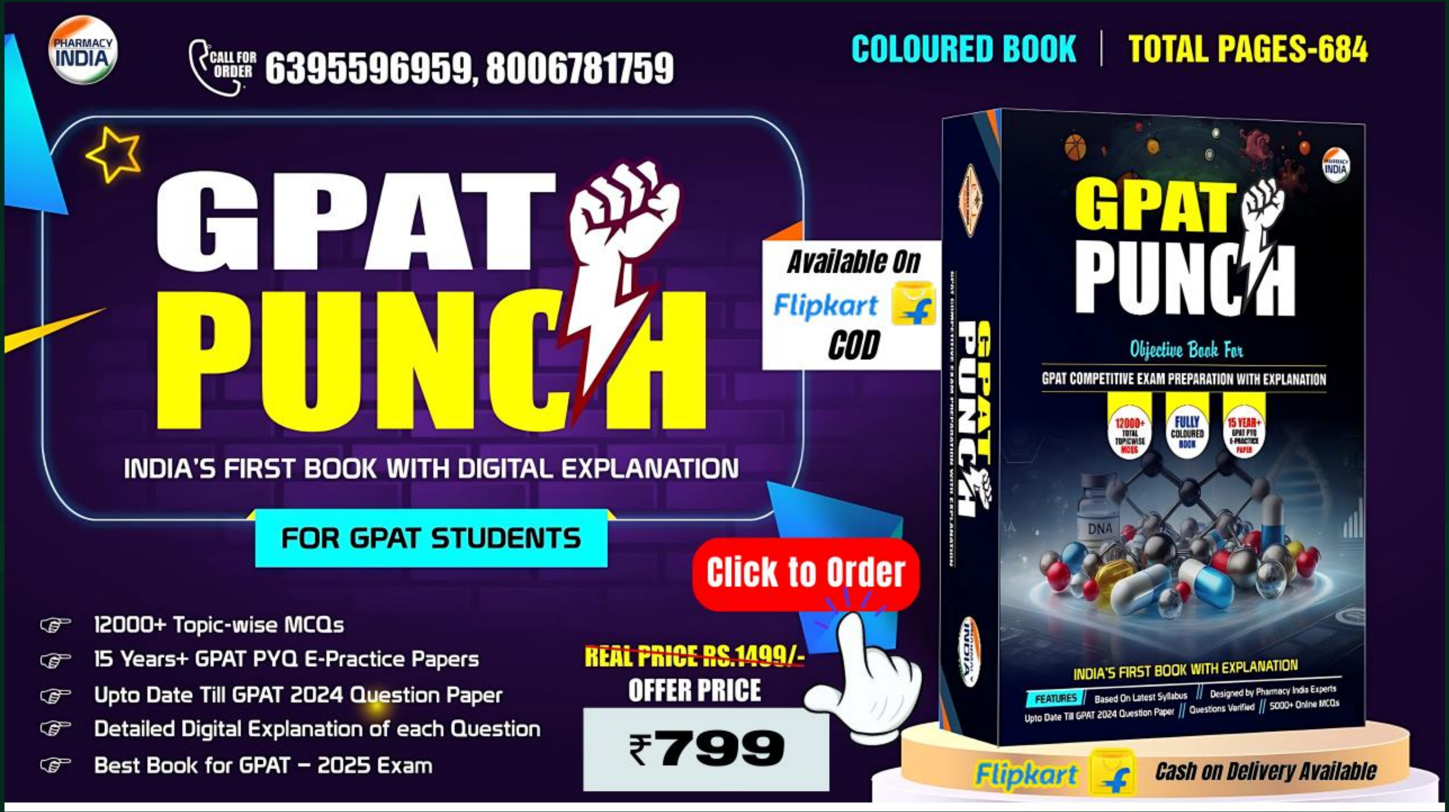


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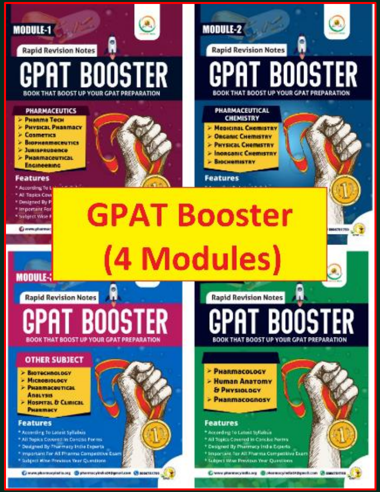

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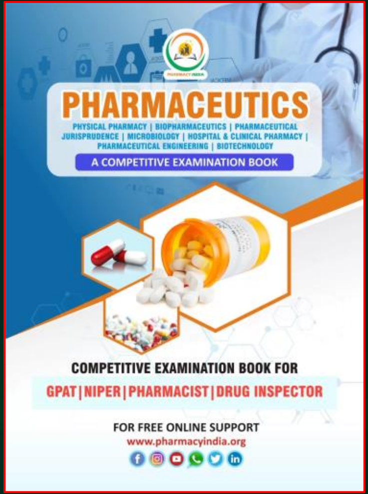

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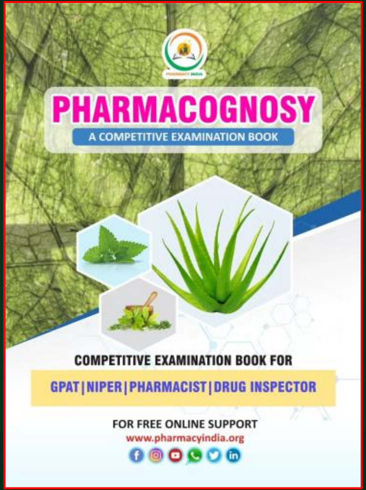

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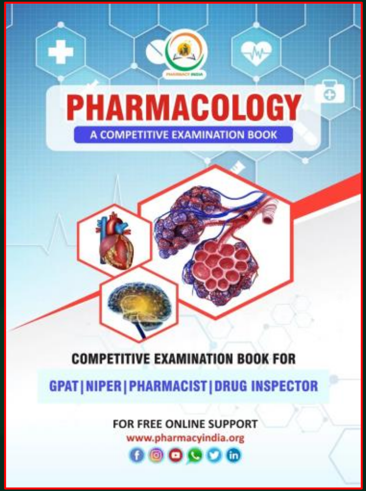

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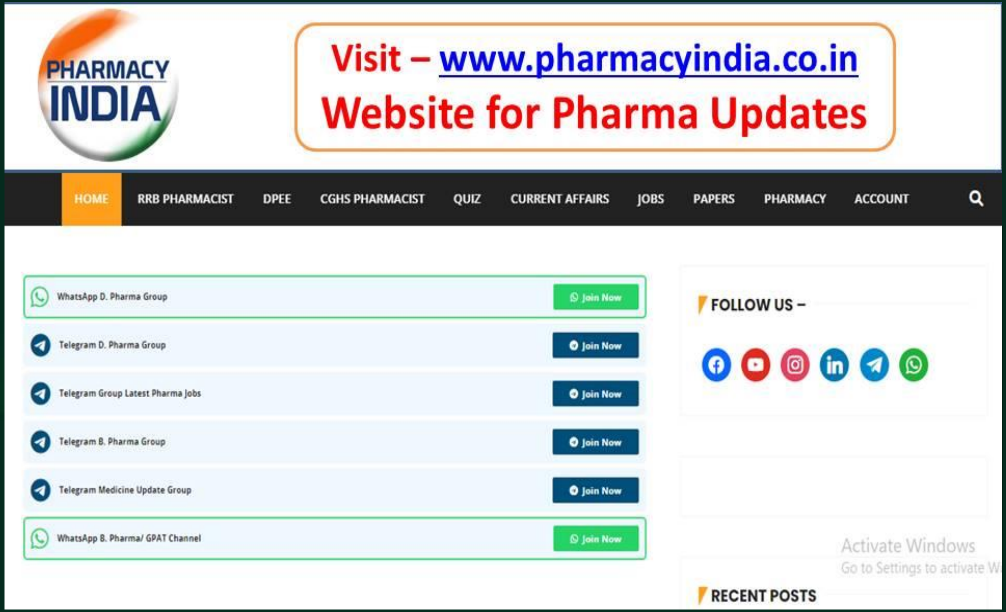

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