Rajasthan Public Service Commission

Factories and Boilers Inspection Department Exam 2025

Inspector of Factories (Chemical) – Question Paper

Exam Date:	19-Sep-2026
Exam Time:	03:00PM to 05:30PM
Test Duration:	150 mins
Total Inspector of Factories (Chemical) Questions:	150
Maximum Marks – Inspector of Factories (Chemical):	150

Inspector of Factories (Chemical) 1	A solid is transformed directly into vapour without passing through the liquid phase when the pressure is:
Choice1	Above the triple-point pressure
Choice2	Equal to the critical pressure
Choice3	Below the triple-point pressure
Choice4	Equal to the saturation pressure
Inspector of Factories (Chemical) 2	Entropy is:
Choice1	Extensive property
Choice2	Intensive property
Choice3	Dimensionless quantity
Choice4	Path function
Inspector of Factories (Chemical) 3	Pure component A in the gas phase enters a reactor. 50% of A is converted to B according to the reaction $A \rightarrow 3B$ The mole fraction of A in the exit stream is:
Choice1	$\frac{1}{2}$
Choice2	$\frac{1}{3}$
Choice3	$\frac{1}{4}$

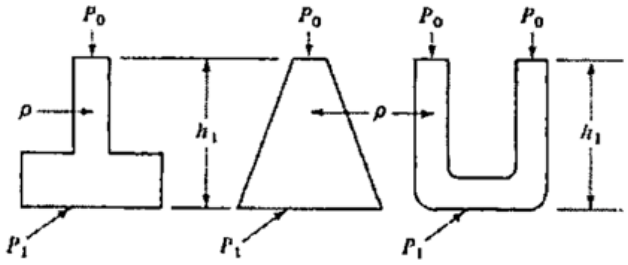
Choice4	$\frac{1}{5}$
Inspector of Factories (Chemical) 4	In an energy balance for a closed system, if no work is performed and changes in kinetic energy and potential energy are negligible, the heat supplied to the system is equal to the change in _____.
Choice1	Internal energy
Choice2	Enthalpy
Choice3	Entropy
Choice4	Gibbs free energy
Inspector of Factories (Chemical) 5	The partial molar Gibbs energy of component $i$in a mixture is equal to its:
Choice1	Activity coefficient, γ_i
Choice2	Mole fraction, x_i
Choice3	Chemical potential, μ_i
Choice4	Partial pressure, ρ_i
Inspector of Factories (Chemical) 6	Given below are two statements: **Statement I:** During a reversible adiabatic expansion of an ideal gas, the entropy remains constant, and the change in internal energy is equal to the work done by the system (considering the appropriate sign convention). **Statement II:** During a reversible isothermal expansion of an ideal gas, the change in internal energy is zero, and the heat absorbed by the system is equal to the work done by the system. In light of the above statements, choose the correct answer from the options given below.
Choice1	Both Statement I and Statement II are true.
Choice2	Both Statement I and Statement II are false.
Choice3	Statement I is true, but Statement II is false.
Choice4	Statement I is false, but Statement II is true.

Inspector of Factories (Chemical) 7	The van der Waals equation of state corrects the ideal gas law by introducing terms for:
Choice1	Heat capacity and viscosity of the gas
Choice2	Thermal conductivity and diffusivity of the gas
Choice3	Molecular volume and molecular attractive forces
Choice4	Surface tension and density of the gas
Inspector of Factories (Chemical) 8	For a reversible process, the change in entropy is best expressed by
Choice1	$dS = \delta Q$
Choice2	$dS = \delta Q_{rev}/T$
Choice3	$dS = \delta W/T$
Choice4	$dS = TdQ$
Inspector of Factories (Chemical) 9	A pure water system consists of ice, liquid water, and water vapor in equilibrium. The degree of freedom of the system is:
Choice1	0
Choice2	1
Choice3	2
Choice4	3
Inspector of Factories (Chemical) 10	Which of the following statements correctly describes entropy?
Choice1	Entropy is a state function
Choice2	Entropy is a path function
Choice3	Entropy remains constant for all thermodynamic processes
Choice4	Entropy has units of pressure

Inspector of Factories (Chemical) 11	For a closed system, the First Law of Thermodynamics is expressed as (work done by the system is assumed to be positive.) :
Choice1	$dU = \delta Q + \delta W$
Choice2	$dU = \delta Q - \delta W$
Choice3	$dU = -\delta Q + \delta W$
Choice4	$dU = \delta W - \delta Q$
Inspector of Factories (Chemical) 12	Which of the following statements is correct regarding the density of liquid mixtures?
Choice1	The density of a liquid mixture is always equal to the arithmetic average of the component densities.
Choice2	The density of a liquid mixture depends only on temperature.
Choice3	The density of a liquid mixture depends on composition, temperature, and pressure.
Choice4	The density of a liquid mixture is independent of intermolecular interactions.
Inspector of Factories (Chemical) 13	In a chemical process, the primary purpose of a bypass stream is to:
Choice1	Increase the residence time of the reactants.
Choice2	Divert a portion of the process stream around a unit operation.
Choice3	Reduce the energy consumption of the reactor.
Choice4	Maintain a constant composition throughout the entire process.
Inspector of Factories (Chemical) 14	For a chemical reaction occurring at equilibrium under constant temperature and pressure, the change in Gibbs free energy is:
Choice1	Positive ($\Delta G > 0$)
Choice2	Negative ($\Delta G < 0$)
Choice3	Zero ($\Delta G = 0$)
Choice4	Equal to the enthalpy change ($\Delta G = \Delta H$)

Inspector of Factories (Chemical) 15	Which of the following correctly represents the Gibbs Phase Rule for a non-reacting system? Where: • F = degrees of freedom • C = number of components • P = number of phases
Choice1	$F = C - P + 2$
Choice2	$F = C + P - 2$
Choice3	$F = C - P - 2$
Choice4	$F = P - C + 2$
Inspector of Factories (Chemical) 16	A branch in a water distribution network splits into two parallel pipes. Pipe A is shorter but rougher, whereas Pipe B is longer but smoother. A constant pressure difference is maintained between the inlet and outlet junctions. Which statement correctly describes the flow distribution?
Choice1	The flow divides such that the head loss through each branch is identical, with the actual flow rates depending on the hydraulic resistance of each branch.
Choice2	Equal flow always occurs because both branches experience the same pressure drop.
Choice3	The shorter pipe always carries the larger flow because the travel distance is smaller.
Choice4	The smoother pipe always carries more flow regardless of its length.
Inspector of Factories (Chemical) 17	During an orifice meter calibration experiment, the downstream pressure decreases below the vapor pressure of the liquid as the flow rate is increased. Under these conditions, which following phenomenon is expected to occur, and what is its consequence on operation of the orifice.
Choice1	Superheating; the liquid temperature will increase exponentially due to local friction created by narrow orifice opening, creating a dense safety hazard.
Choice2	Thermal Choking; the liquid will undergo an isothermal phase change that locs the volumetric flow rate at constant maximum value.

Choice3	Sublimation; the liquid will directly transition into a solid crystal state at the vena contracta, completely blocking the flow.
Choice4	Cavitation; it will cause vapor bubbles to form and violently collapse, resulting in structural erosion and reading inaccuracies.
Inspector of Factories (Chemical) 18	A process requires pumping a 60,000 cP shear-sensitive polymer melt at 250°C. The pump must deliver uniform flow with minimal pressure pulsation, maintain dimensional consistency of the extruded product, and operate against discharge pressures that fluctuate during production. Which pump is the most suitable?
Choice1	A rotary positive displacement pump
Choice2	A regenerative turbine pump
Choice3	An Axial-flow pump
Choice4	Reciprocating plunger pump
Inspector of Factories (Chemical) 19	For a **steady incompressible flow** through a pipe with varying cross-sectional area, what happens to the fluid velocity when the cross-sectional area decreases?
Choice1	It decreases in direct proportion to the reduction in area.
Choice2	It increases in accordance with the continuity equation.
Choice3	It remains constant throughout the pipe.
Choice4	It becomes zero at the smaller cross-section.
Inspector of Factories (Chemical) 20	Which of the following statements correctly defines a Newtonian fluid?
Choice1	A fluid whose viscosity decreases as the applied shear rate increases
Choice2	A fluid whose viscosity increases as the applied shear rate increases
Choice3	A fluid whose viscosity stays constant irrespective of the applied shear rate
Choice4	A fluid whose response to applied shear stress is partly elastic in nature

Inspector of Factories (Chemical) 21	The Darcy–Weisbach equation gives the frictional head loss in a pipe as a function of which of the following?
Choice1	Flow rate and pipe length only, with no other quantities involved
Choice2	Fluid velocity and pipe diameter only, with no other quantities involved
Choice3	Friction factor, pipe length, pipe diameter, and the velocity head
Choice4	Reynolds number and fluid viscosity only, with no other quantities involved
Inspector of Factories (Chemical) 22	Which of the following pumps is **best suited for pumping highly viscous fluids** in industrial processes?
Choice1	Centrifugal pump
Choice2	Gear pump
Choice3	Axial flow pump
Choice4	Diaphragm pump
Inspector of Factories (Chemical) 23	Three vessels of different shapes are filled with the same liquid up to the same height h_1 and are open to the atmosphere, as shown in the figure. If $P_0$is the atmospheric pressure, the pressure at the bottom of each vessel is: 
Choice1	Greatest in the second vessel because it contains the largest volume of liquid.
Choice2	Greatest in the first vessel because the liquid column is taller.
Choice3	The same for all three vessels
Choice4	Different for each vessel because pressure depends on the shape of the container.

Inspector of Factories (Chemical) 24	Which dimensionless number represents inertia to gravity force?
Choice1	Reynolds number
Choice2	Weber number
Choice3	Euler number
Choice4	Froude number
Inspector of Factories (Chemical) 25	A large cylindrical water tank is open to the atmosphere and filled to a height of 5 m above the outlet tap. Upon opening the tap, the water flows out to the atmosphere through the smooth and rounded outlet. Assuming flow is irrotational, incompressible and steady. Calculate the exit velocity of the water. (Take $g = 10$ m/s^2).
Choice1	8.9 m/s
Choice2	10.0 m/s
Choice3	15 m/s
Choice4	18.5 m/s
Inspector of Factories (Chemical) 26	A fluid type that is less resistant at higher strain rate is called _____.
Choice1	Newtonian
Choice2	Dilatant
Choice3	Bingham
Choice4	Pseudoplastic
Inspector of Factories (Chemical) 27	Which of the following instruments is most suitable for measuring the velocity of a fluid at a specific point in a flow field?
Choice1	Manometer
Choice2	Venturimeter
Choice3	Pitot tube
Choice4	Rotameter

Inspector of Factories (Chemical) 28	The friction factor used in pipe flow analysis can be expressed either as the Darcy friction factor (f_D) or the Fanning friction factor (f_F). Which of the following correctly relates these two friction factors?
Choice1	$f_D = f_F$
Choice2	$f_D = 2f_F$
Choice3	$f_D = 4f_F$
Choice4	$f_D = \frac{f_F}{4}$
Inspector of Factories (Chemical) 29	What are the correct flow assumptions for the derivation of the Bernoulli equation?
Choice1	Unsteady, compressible, frictionless
Choice2	Steady , compressible, flow along a single streamline
Choice3	Steady flow, incompressible flow, frictionless flow, and flow along a single streamline
Choice4	Unsteady flow, incompressible flow, frictionless flow, and flow along a single streamline
Inspector of Factories (Chemical) 30	Cavitation occurs when:
Choice1	Re>4000
Choice2	Static pressure falls below vapor pressure
Choice3	Flow becomes supersonic
Choice4	Dynamic pressure becomes zero
Inspector of Factories (Chemical) 31	The ratio of heat conducted to heat stored is called as _____

Choice1	Heat transfer coefficient
Choice2	Thermal conductivity
Choice3	Thermal diffusivity
Choice4	Heat capacity
Inspector of Factories (Chemical) 32	A fin effectiveness of $(\varepsilon_{fin}) = 1$indicates that the addition of fins to the surface ___
Choice1	Does not affect heat transfer at all
Choice2	Enhances the heat transfer
Choice3	Decreases the heat transfer
Choice4	First enhances and then remains constant
Inspector of Factories (Chemical) 33	When the Biot number (Bi>1) is greater than ONE, which of the following statements is TRUE?
Choice1	Internal conduction resistance is negligible compared to the external convection resistance
Choice2	Temperature within the solid is uniform at any instant of time
Choice3	Lumped system analysis can be accurately used for transient heat transfer
Choice4	External convection resistance is negligible compared to the internal conduction resistance
Inspector of Factories (Chemical) 34	Evaporation is a liquid-to-vapor phase change process, which occurs at the liquid–vapor interface when _____
Choice1	The vapor pressure is less than the saturation pressure of the liquid at a given temperature.
Choice2	The vapor pressure is more than the saturation pressure of the liquid at a given temperature.
Choice3	The vapor pressure is the same as the saturation pressure of the liquid at a given temperature.

Choice4	The vapor pressure is the same as the external pressure of the liquid at a given temperature.
Inspector of Factories (Chemical) 35	The statement – “view factor from a surface ‘i’ to a surface ‘j’ is equal to the sum of the view factors from surface ‘i’ to the parts of surface ‘j’ ”, is called as ___
Choice1	Reciprocity rule
Choice2	Summation rule
Choice3	Superposition Rule
Choice4	Symmetry Rule
Inspector of Factories (Chemical) 36	Under what conditions is the following heat transfer relation valid for a heat exchanger? $\dot{Q} = \dot{m}_c C_{pc}(T_{c,out} - T_{c,in}) = \dot{m}_h C_{ph}(T_{h,in} - T_{h,out})$
Choice1	Steady operating conditions exist, the heat exchanger is well-insulated (no heat loss to the surroundings), and fluid properties are constant
Choice2	The heat exchanger operates under transient conditions with significant heat loss to the environment and variable fluid properties
Choice3	Only the cold fluid side energy balance is valid, regardless of insulation or operating conditions
Choice4	The heat exchanger has axial heat conduction in the metal pipe, unsteady flow, and significant kinetic/potential energy changes
Inspector of Factories (Chemical) 37	In the flow of a liquid through a heated circular pipe, heat is transferred from the hot pipe wall to the liquid primarily by:
Choice1	Conduction only
Choice2	Convection only
Choice3	Radiation only
Choice4	Conduction through the fluid layer adjacent to the wall, followed by convection within the flowing liquid

Inspector of Factories (Chemical) 38	Consider flow over a flat plate. The horizontal plate with temperature ($T_s > T_\infty$), is maintained at a higher temperature than the inlet stream. For this example, consider the following two cases: Case A: Water (*Pr*~7) is flowing over a flat plate Case B: Engine Oil (*Pr*~100) is flowing over a flat plate Which of the following statements regarding the thickness of the THERMAL boundary layer (δ_{TBL}) is true?
Choice1	$\delta_{TBL}\,(CaseA) > \delta_{TBL}\,(CaseB)$
Choice2	$\delta_{TBL}\,(CaseA) < \delta_{TBL}\,(CaseB)$
Choice3	$\delta_{TBL}\,(CaseA) = \delta_{TBL}\,(CaseB)$
Choice4	None of above
Inspector of Factories (Chemical) 39	Thermal conductivity of copper (Cu) and Nickel (Ni) is 401 W/m ^{O}C and 91 W/m ^{O}C respectively at 300K. If both are used to make their alloy named constantan (55% Cu and 45% nickel), then thermal conductivity of resulting alloy would be:
Choice1	Equal or greater than 401 W/m ^{O}C
Choice2	246 W/m ^{O}C
Choice3	261.5 W/m ^{O}C
Choice4	Less than 91 W/m ^{O}C
Inspector of Factories (Chemical) 40	In a concentric pipe heat exchanger, the concentric annulus has inner diameter Di and outside diameter Do. The hydraulic diameter of the annulus will be:
Choice1	$Do - Di$
Choice2	$\frac{Do-Di}{2}$
Choice3	$\frac{Do^2-Di^2}{Di}$
Choice4	$\frac{Do^2-Di^2}{4}$

Inspector of Factories (Chemical) 41	Select an appropriate heat exchanger for an aerospace application where weight and space are severely constrained:
Choice1	Gasketed plate heat exchanger
Choice2	Double pipe heat exchanger
Choice3	Shell and tube heat exchanger
Choice4	Compact plate-fin heat exchanger
Inspector of Factories (Chemical) 42	Which of the following is NOT an advantage of using baffles in a shell-and-tube heat exchanger?
Choice1	Increased shell-side heat transfer coefficient
Choice2	Improved tube support
Choice3	Reduced shell-side pressure drop
Choice4	Enhanced shell-side turbulence
Inspector of Factories (Chemical) 43	Under what operating condition is the effectiveness of a heat exchanger independent of its flow arrangement (parallel, counter or cross flow)?
Choice1	When the heat exchanger operates under highly turbulent flow conditions
Choice2	When the heat capacity rates of both the fluids are same ($C_h = C_c$)
Choice3	When one of the fluids undergoes a phase change (condenser or evaporator)
Choice4	When the overall heat transfer coefficient is extremely low
Inspector of Factories (Chemical) 44	In a counterflow heat exchanger in which the two fluids have **equal heat-capacity rates**, how does the local temperature difference between the hot and cold fluids vary along the length?
Choice1	It stays essentially constant from one end of the exchanger to the other
Choice2	It decreases continuously from the hot-fluid inlet to the hot-fluid outlet
Choice3	It increases continuously along the direction of hot-fluid flow
Choice4	It first rises to a maximum at the mid-length and then falls again

Inspector of Factories (Chemical) 45	The Biot number, a crucial dimensionless number in transient heat conduction is interpreted in terms of its physical significance as:
Choice1	Ratio of momentum diffusivity to thermal diffusivity.
Choice2	Ratio of thermal energy stored to the thermal energy conducted.
Choice3	Ratio of conductive heat transfer rate to the convective heat transfer rate.
Choice4	Ratio of internal thermal resistance of a solid to the external convective thermal resistance.
Inspector of Factories (Chemical) 46	When the equilibrium relationship is linear and the solute is highly soluble in the liquid phase, the overall resistance to mass transfer is controlled mainly by:
Choice1	The gas-phase resistance
Choice2	The liquid-phase resistance
Choice3	Both phases equally, always
Choice4	Neither phase offers any resistance
Inspector of Factories (Chemical) 47	When the solute has a very low solubility in the liquid phase (a large Henry's law constant), the controlling resistance to mass transfer normally lies in:
Choice1	The gas phase
Choice2	The liquid phase
Choice3	The solid phase
Choice4	The interface itself
Inspector of Factories (Chemical) 48	According to the two-film theory, the resistance to mass transfer is assumed to reside in:
Choice1	Turbulent eddies near the interface
Choice2	The bulk of each phase only
Choice3	A single film on the gas side only

Choice4	Thin, stagnant films adjacent to the interface on each side
Inspector of Factories (Chemical) 49	The major limitation of the penetration theory, addressed by the surface renewal theory, is the assumption that:
Choice1	All fluid elements have the same diffusivity
Choice2	The bulk fluid is stagnant
Choice3	All fluid elements are exposed at the interface for the same length of time
Choice4	The interface is not at equilibrium
Inspector of Factories (Chemical) 50	The overall mass transfer coefficient is used in preference to individual phase coefficients mainly because:
Choice1	Individual phase coefficients cannot be measured at all
Choice2	Overall coefficients are always numerically larger
Choice3	Only one phase resistance ever exists
Choice4	Interfacial concentrations are not directly measurable in practice
Inspector of Factories (Chemical) 51	A continuous contacting (differential) device, such as a packed tower, differs from a stagewise device in that:
Choice1	Concentration changes occur abruptly between discrete equilibrium stages
Choice2	The compositions of both phases change continuously and gradually along the path of contact
Choice3	No equilibrium curve is needed in its design
Choice4	Only batch operation is possible
Inspector of Factories (Chemical) 52	In which of the following situations, Knudsen diffusion is expected to be significant?
Choice1	Liquid-phase diffusion through large pores
Choice2	Gas-phase diffusion through a very fine pore at low pressure

Choice3	Diffusion in a molten metal
Choice4	Gas-phase diffusion through a large-diameter pipe at high pressure
Inspector of Factories (Chemical) 53	Liquid-liquid extraction is an attractive alternative to distillation particularly when:
Choice1	The components to be separated have a high relative volatility
Choice2	The components to be separated have very close boiling points, making distillation impractical
Choice3	Only gaseous mixtures are involved
Choice4	High temperatures are desired for separation
Inspector of Factories (Chemical) 54	Given below are two statements: **Statement I:** The **wet-bulb temperature** is the steady-state temperature attained by a small quantity of liquid evaporating under adiabatic conditions into a continuously flowing gas stream. **Statement II:** For an unsaturated air–water vapour mixture, the wet-bulb temperature is always higher than the dry-bulb temperature. In light of the above statements, choose the correct answer from the options given below.
Choice1	Both Statement I and Statement II are true.
Choice2	Both Statement I and Statement II are false.
Choice3	Statement I is true, but Statement II is false.
Choice4	Statement I is false, but Statement II is true.
Inspector of Factories (Chemical) 55	Which of the following statements regarding a **binary mixture separated in a tray distillation column with non-ideal stages** is correct?
Choice1	The point efficiency may be greater than 100%.
Choice2	The Murphree tray efficiency can never exceed 100%.
Choice3	The Murphree tray efficiency may exceed 100%.
Choice4	Both the Murphree tray efficiency and the point efficiency may exceed 100%.

Inspector of Factories (Chemical) 56	"Diffusional extraction," as a category of solid-liquid extraction, refers to systems in which:
Choice1	Mass transfer resistance lies almost entirely in the solid phase.
Choice2	Mass transfer resistance lies entirely in the liquid phase.
Choice3	No diffusion occurs; only mechanical washing takes place.
Choice4	The solid completely dissolves instantly.
Inspector of Factories (Chemical) 57	For an ideal solution obeying Raoult's law, the partial pressure of a component is proportional to its:
Choice1	Mass fraction
Choice2	Mole fraction in the vapor phase
Choice3	Mole fraction in the liquid phase
Choice4	Density
Inspector of Factories (Chemical) 58	Given below are two statements: **Statement I:** The reflux ratio influences both the separation efficiency and the energy requirement of a distillation column. **Statement II:** Increasing the reflux ratio always enhances separation without causing any increase in operating costs. In light of the above statements, choose the correct answer from the options given below.
Choice1	Both Statement I and Statement II are true.
Choice2	Both Statement I and Statement II are false.
Choice3	Statement I is true, but Statement II is false.
Choice4	Statement I is false, but Statement II is true.
Inspector of Factories (Chemical) 59	The "constant rate period" of drying is primarily controlled by:
Choice1	External convective heat and mass transfer resistance at the wetted surface of the solid.

Choice2	The internal diffusion of moisture within the solid.
Choice3	Chemical binding forces between moisture and solid.
Choice4	The thermal conductivity of the dry solid only.
Inspector of Factories (Chemical) 60	In the drying of solids, moisture that exerts an **equilibrium vapour pressure lower than that of pure water** at the same temperature is known as:
Choice1	Unbound moisture
Choice2	Free moisture
Choice3	Bound moisture
Choice4	Surface moisture
Inspector of Factories (Chemical) 61	For a distillation column operating with a saturated liquid feed, the slope of the q-line is:
Choice1	Equal to zero, giving a horizontal q-line
Choice2	Infinite in magnitude, giving a vertical q-line
Choice3	Greater than unity but finite in magnitude
Choice4	Less than unity but greater than zero
Inspector of Factories (Chemical) 62	According to the penetration theory of mass transfer, the liquid-phase mass transfer coefficient is proportional to:
Choice1	D_{AB}
Choice2	$\sqrt{D_{AB}}$
Choice3	$\frac{1}{D_{AB}}$
Choice4	$\frac{1}{\sqrt{D_{AB}}}$
Inspector of Factories (Chemical) 63	In an ideal leaching stage, equilibrium between the solid and liquid phases is considered to be established when:

Choice1	The solute is entirely adsorbed onto the outer surface of the solid particles present
Choice2	The solution retained by the solid has the same composition as the overflow solution leaving
Choice3	The solid particles retain no liquid at all once separated from the surrounding solution
Choice4	The overflow stream and the underflow stream leave the stage at identical mass flow rates
Inspector of Factories (Chemical) 64	For dilute solutions of non-electrolytes, the molecular diffusivity in a liquid generally varies with temperature as:
Choice1	$D_{AB} \propto \frac{1}{T}$
Choice2	$D_{AB} \propto T$
Choice3	$D_{AB} \propto \mu T$
Choice4	$D_{AB} \propto \frac{T}{\mu}$
Inspector of Factories (Chemical) 65	In a ternary equilibrium (triangular) diagram used for liquid-liquid extraction, a tie line joins:
Choice1	The two terminal points that bound the plait point region of the diagram
Choice2	The equilibrium compositions of the extract phase and the raffinate phase
Choice3	The feed mixture composition directly to the added pure solvent composition
Choice4	The points representing two liquid mixtures that happen to share equal density
Inspector of Factories (Chemical) 66	According to the collision theory of chemical reactions, the rate constant (k) is directly proportional to which of the following expressions?
Choice1	T
Choice2	$Te^{-\frac{E}{RT}}$
Choice3	$e^{-\frac{E}{RT}}$

Choice4	$T^{\frac{1}{2}}e^{-\frac{E}{RT}}$
Inspector of Factories (Chemical) 67	In the design equations, how does the reaction rate, -r_A appear for a mixed flow reactor (MFR) compared with a plug flow reactor (PFR)?
Choice1	It varies along both the MFR and the PFR reactor lengths.
Choice2	It stays constant in both the MFR and the PFR reactor volumes.
Choice3	It stays constant in the MFR but varies along the PFR length.
Choice4	It varies within the MFR but stays constant along the PFR length.
Inspector of Factories (Chemical) 68	As the number N of **equal-size mixed flow reactors in series** is increased (for an nth-order reaction, n > 0), the overall performance of the system:
Choice1	Approaches that of a single large MFR of the same total volume.
Choice2	Approaches that of a plug flow reactor, reaching it as N → ∞.
Choice3	Becomes independent of the number of reactors used.
Choice4	Requires progressively larger total volume for the same conversion.
Inspector of Factories (Chemical) 69	A proposed reaction mechanism predicts the overall reaction $2A + B \rightarrow Products$ Experimental measurements yield the rate law $r_p = k\,[A]\,[B]$ Which conclusion is most appropriate?
Choice1	The overall reaction is non-elementary, and it follows more complex mechanisms
Choice2	The experimental data are inconsistent because reaction order must equal the stoichiometric coefficients.
Choice3	The balanced equation should be rewritten to match the measured rate law.
Choice4	The catalyst has altered the stoichiometric coefficients of the reaction.

Inspector of Factories (Chemical) 70	Space time for a plug flow reactor (for a first order reaction) is:
Choice1	$Kln\frac{C}{C_0}$
Choice2	$\frac{1}{K}ln\frac{C_0}{C}$
Choice3	$\frac{1}{K}\frac{C_0}{C}$
Choice4	$Kln\frac{C_0}{C}$
Inspector of Factories (Chemical) 71	For an ideal **plug flow reactor (PFR)** carrying out a **single first-order reaction**, how does the concentration of the reactant vary along the reactor?
Choice1	It remains unchanged from the inlet to the outlet.
Choice2	It increases uniformly as the fluid flows through the reactor.
Choice3	It decreases exponentially in the direction of flow.
Choice4	It decreases at a constant linear rate throughout the reactor.
Inspector of Factories (Chemical) 72	A chemical plant operates two parallel reactions: • Desired reaction: E_a = 70 kJ/mol • Undesired reaction: E_a = 130 kJ/mol Both reactions have nearly identical pre-exponential factors. To increase production, the reactor temperature is raised by 20°C. Which engineering concern is most justified?
Choice1	The desired reaction will become significantly more selective because of its lower activation energy.
Choice2	The undesired reaction will accelerate proportionally more, potentially reducing product selectivity despite higher overall conversion.
Choice3	Both reactions will respond equally because they have identical pre-exponential factors.
Choice4	Product distribution will remain unchanged because activation energy affects only the equilibrium constant.

Inspector of Factories (Chemical) 73	If n = overall order of a chemical reaction. a = Initial concentration of reactant t = Time required to complete a definite fraction of the reaction. Then pick out the correct corelation:
Choice1	$t \propto \frac{1}{a^n}$
Choice2	$t \propto \frac{1}{a^{n-1}}$
Choice3	$t \propto \frac{1}{a^{n+1}}$
Choice4	$t \propto a^n$
Inspector of Factories (Chemical) 74	The rate of the chemical reaction A → B doubles as the concentration of A, i.e., C_A is doubled. If the rate of reaction is proportional to C_A^n, then what is the value of n for this reaction?
Choice1	0.5
Choice2	1
Choice3	0
Choice4	2
Inspector of Factories (Chemical) 75	The conversion for a first-order liquid phase reaction $A \rightarrow B$in a CSTR is 50%. If another CSTR of the same volume is connected in series, then the % conversion at the exit of the second reactor will be:
Choice1	60
Choice2	75
Choice3	90
Choice4	100
Inspector of Factories (Chemical) 76	For the first-order reaction, the time for half the reaction was 10 min where the initial concentration was 6 x 10^{-2} moles/L. What is the specific reaction rate constant?

Choice1	0.069 min^{-1}
Choice2	0.69 min^{-1}
Choice3	0.138 min^{-1}
Choice4	1.38 min^{-1}
Inspector of Factories (Chemical) 77	For a mixed flow reactor, operating at steady state, the rate of reaction is given by:
Choice1	$\frac{F_{AO}}{V} - \frac{dC_A}{dt}$
Choice2	$\frac{F_{AO}}{V} + \frac{dC_A}{dt}$
Choice3	$\frac{F_{AO}X_A}{V}$
Choice4	$\frac{-dC_A}{dt}$
Inspector of Factories (Chemical) 78	A gas-phase reaction $A \rightarrow 3R$ is carried out isothermally in a PFR. A design engineer ignores gas expansion and sizes the reactor using constant-density equations. What is the most likely consequence?
Choice1	The reactor will be oversized because the reaction rate increases with expansion.
Choice2	The reactor will be undersized because gas expansion lowers reactant concentration and reaction rate.
Choice3	The reactor size will be unaffected because first-order reactions depend only on temperature.
Choice4	The pressure drop will compensate exactly for gas expansion.
Inspector of Factories (Chemical) 79	A process engineer replaces a PFR with a CSTR without changing feed composition or residence time. After startup, the selectivity to the desired product decreases. Which reaction network is most consistent with this observation?
Choice1	$r_D = k_1 C_A^2, r_U = k_2 C_A$

Choice2	$r_D = k_1 C_A, r_U = k_2 C_A^2$
Choice3	$r_D = k_1 C_A, r_U = k_2 C_A$
Choice4	$r_D = k_1, r_U = k_2$
Inspector of Factories (Chemical) 80	Given below are two statements: **Statement I:** The order of a homogeneous reaction is determined solely by the stoichiometric coefficients of the reactants. **Statement II:** The rate constant of a homogeneous reaction depends on temperature but is independent of the concentrations of the reactants. In light of the above statements, choose the correct answer from the options given below.
Choice1	Both Statement I and Statement II are true.
Choice2	Both Statement I and Statement II are false.
Choice3	Statement I is true, but Statement II is false.
Choice4	Statement I is false, but Statement II is true.
Inspector of Factories (Chemical) 81	A feed of 100 mol of pure A is processed through the parallel reactions $A \rightarrow B$ $A \rightarrow C.$ The reactor effluent contains 40 mol A, 45 mol B, and 15 mol C. Which of the following statements is correct?
Choice1	The conversion is 60%, the yield of B is 45%, and the selectivity of B relative to C is 3.0.
Choice2	The conversion is 60%, the yield is 75%, and the selectivity is 3.0.
Choice3	The conversion is 45%, because only 45 mol of desired product is obtained.
Choice4	The selectivity is 75%, because 75% of the reacted A forms the desired product.

Inspector of Factories (Chemical) 82	A batch reactor carries out the reactions $A \xrightarrow{k_1} R \xrightarrow{k_2} S$ With $-r_A = k_1$, $-r_R = k_2 C_R$ During operation, operators observe that A is still detectable, yet the concentration of R begins to decrease while S continues to increase. Which conclusion is most appropriate?
Choice1	The zero-order reaction has terminated because the concentration of A has become low.
Choice2	The rate of formation of R is still constant, but its first-order consumption has become larger than its formation rate.
Choice3	The reactor has reached steady state.
Choice4	The catalyst has become inactive.
Inspector of Factories (Chemical) 83	For a variable-volume batch reactor, which of the following expressions correctly represents the reaction rate, $-r_A$, in terms of conversion (X_A)?
Choice1	$-r_A = C_{A0}\varepsilon_A X_A \frac{dX_A}{dt}$
Choice2	$-r_A = \frac{C_{A0}}{\varepsilon_A X_A}\frac{dX_A}{dt}$
Choice3	$-r_A = \frac{\varepsilon_A}{C_A X_A}\frac{dX_A}{dt}$
Choice4	$-r_A = \frac{C_{A0}}{1+\varepsilon_A X_A}\frac{dX_A}{dt}$
Inspector of Factories (Chemical) 84	The half-life of the n^{th}-order reaction in batch reactor depends on-
Choice1	only the rate constant.
Choice2	only the rate constant and the order of the reaction.
Choice3	only the rate constant and the initial reactant concentration.
Choice4	The rate constant, initial reactant concentration and the order of the reaction.

Inspector of Factories (Chemical) 85	For the elementary reaction $B + 2D \rightarrow 3T,$ the rate equations are written as $-r_B = k_B C_B C_D^2,\ -r_D = k_D C_B C_D^2,\ r_T = k_T C_B C_D^2$ The correct relationship among the rate constants is:
Choice1	$k_B = 2k_D = 3k_T$
Choice2	$k_B = \frac{1}{2}k_D = \frac{1}{3}k_T$
Choice3	$k_B = k_D = k_T$
Choice4	$k_B = \frac{3}{2}k_D = \frac{2}{3}k_T$
Inspector of Factories (Chemical) 86	Which of the following is an example of a wide aperture release?
Choice1	A small crack in a flange causing a slow leak
Choice2	A pinhole leak in a pipeline
Choice3	Overpressuring and explosion of a storage tank
Choice4	A partially open valve leaking process fluid
Inspector of Factories (Chemical) 87	The fatal accident rate (FAR) reports the number of fatalities based on 1000 employees working
Choice1	10^6working hours
Choice2	10^7working hours
Choice3	10^8working hours
Choice4	10^5working hours
Inspector of Factories (Chemical) 88	OSHA stands for:
Choice1	Occupational Safety and Health Administration

Choice2	Organization for Safety and Hazard Assessment
Choice3	Occupational Standards and Hazard Authority
Choice4	Office of Safety and Health Assessment
Inspector of Factories (Chemical) 89	Autoignition temperature (AIT) is _____
Choice1	A fixed temperature ABOVE which adequate energy is available in the environment to provide an ignition source
Choice2	A fixed temperature BELOW which adequate energy is available in the environment to provide an ignition source
Choice3	A RANGE OF temperature in which adequate energy is available in the environment to provide an ignition source
Choice4	A temperature at which ignition is NOT needed for fire
Inspector of Factories (Chemical) 90	While dealing with responses (may or may not be reversible) of toxicants to the human body, which of the following terms is used to denote the effects on the kidney?
Choice1	Hemotoxic
Choice2	Hepatotoxic
Choice3	Pulmonotoxic
Choice4	Nephrotoxic
Inspector of Factories (Chemical) 91	The three phases in any industrial hygiene project are identification, evaluation, and Control. Which of the following best describes the evaluation?
Choice1	determination of the magnitude of exposure
Choice2	application of appropriate technology to reduce workplace exposures to acceptable levels
Choice3	determination of the possibility of workplace exposures
Choice4	application of appropriate technology to reduce the probability of workplace exposures

Inspector of Factories (Chemical) 92	The fatality rate is defined as:
Choice1	Number of injuries per 100 workers.
Choice2	Number of fatalities per year divided by the total number of people in the applicable population.
Choice3	Number of fatalities divided by total work hours.
Choice4	Number of lost workdays per employee.
Inspector of Factories (Chemical) 93	An explosion in which the reaction front moves at a speed less than the speed of sound in the unreacted medium is called as_____
Choice1	Fire
Choice2	Deflagration
Choice3	Detonation
Choice4	Mechanical explosion
Inspector of Factories (Chemical) 94	Boiling-liquid expanding-vapor explosion (BLEVE) occurs when a vessel ruptures, containing a liquid that is:
Choice1	At a temperature below its atmospheric boiling point
Choice2	At a temperature above its atmospheric boiling point
Choice3	At a temperature above its supersaturation temperature
Choice4	At a temperature below its supersaturation temperature
Inspector of Factories (Chemical) 95	A worker is exposed to a solvent vapor at the following concentrations during an 8-hour shift: 150 ppm for 2 hours, 75 ppm for 4 hours, and 25 ppm for 2 hours. What is the Time-Weighted Average (TWA) concentration?
Choice1	81.25 ppm
Choice2	108.3 ppm
Choice3	83.3 ppm
Choice4	100 ppm

Inspector of Factories (Chemical) 96	Particles obtained from homogeneous solids generally have:
Choice1	Different densities from the bulk material.
Choice2	The same density as the bulk material.
Choice3	Lower density than the bulk material.
Choice4	Higher density than the bulk material.
Inspector of Factories (Chemical) 97	In Tyler Series, the ratio of the aperture size of a screen to that of the next smaller screen is:
Choice1	$\frac{1}{\sqrt{2}}$
Choice2	$\sqrt{2}$
Choice3	1.5
Choice4	2
Inspector of Factories (Chemical) 98	Ultrafine wet grinding is done in-
Choice1	Fluid energy mills
Choice2	Hammer mills
Choice3	Agitated mills
Choice4	All of these
Inspector of Factories (Chemical) 99	Rittinger's law can be obtained from generalized differential relation: $d\left(\frac{P}{\dot{m}}\right) = -K\frac{d\bar{D}_s}{d\bar{D}_s^n}$ When the exponent 'n' is equal to:
Choice1	0.5
Choice2	1.0
Choice3	1.5

Choice4	2.0
Inspector of Factories (Chemical) 100	Compression is generally used for:
Choice1	Fine grinding of soft materials.
Choice2	Coarse reduction of hard solids.
Choice3	Cutting plastics into cubes.
Choice4	Producing powders by rubbing.
Inspector of Factories (Chemical) 101	Which of the following is NOT a common mechanism of size reduction?
Choice1	Compression
Choice2	Impact
Choice3	Attrition
Choice4	Filtration
Inspector of Factories (Chemical) 102	Which statement best describes the working principle of an industrial vibrating screen?
Choice1	Separation occurs solely due to density differences.
Choice2	Separation occurs according to particle size through screen apertures.
Choice3	Separation occurs according to particle colour.
Choice4	Separation occurs according to magnetic properties.
Inspector of Factories (Chemical) 103	Material **A** has a Bond's Work Index of **12 kWh/tonne**, while Material **B** has a Bond's Work Index of **18 kWh/tonne**. Which statement is correct?
Choice1	Material A is harder to grind.
Choice2	Material B is easier to grind.
Choice3	Material B requires more energy for grinding.
Choice4	Both materials require equal grinding energy.

Inspector of Factories (Chemical) 104	Size analysis was carried out on a sample of gravel. The data for mass fraction x_i and average particle diameter ($\overline{D}_{pi}$) of the fraction is given in the table below: x_i | $\overline{D}_{pi}\ (mm)$ 0.2 | 5 0.4 | 10 0.4 | 20 The mass mean diameter of the sample, to the nearest integer is:
Choice1	10 mm
Choice2	11 mm
Choice3	12 mm
Choice4	13 mm
Inspector of Factories (Chemical) 105	The crushing efficiency (η_c) is defined as the ratio of:
Choice1	Energy absorbed by the solid to total machine power input.
Choice2	Surface energy created by crushing to the energy absorbed by the solid.
Choice3	Surface area of product to surface area of feed.
Choice4	Mechanical efficiency to crushing efficiency.
Inspector of Factories (Chemical) 106	In a Mikro-Atomizer hammer mill with internal classification, whether a particle is discharged as product or return for further grinding primarily depends on:
Choice1	The impact force exerted by the hammers

Choice2	The balance between air-drag force and centrifugal force exerted by the separator vanes.
Choice3	The density difference between particles and air.
Choice4	The residence time of particles in the grinding chamber.
Inspector of Factories (Chemical) 107	Consider a cylinder (diameter D and length D), a sphere (Diameter D) and a cube (side length D), which of the following statements concerning the sphericity (Φ) of the above object is true?
Choice1	$\Phi_{sphere} > \Phi_{cylinder} > \Phi_{cube}$
Choice2	$\Phi_{sphere} = \Phi_{cylinder} = \Phi_{cube}$
Choice3	$\Phi_{sphere} < \Phi_{cylinder} < \Phi_{cube}$
Choice4	$\Phi_{sphere} > \Phi_{cylinder} = \Phi_{cube}$
Inspector of Factories (Chemical) 108	For many crushed materials, the sphericity (Φ_s) generally lies between:
Choice1	0.2 and 0.4
Choice2	0.4 and 0.6
Choice3	0.6 and 0.8
Choice4	0.8 and 1.2
Inspector of Factories (Chemical) 109	Coarse particles are generally measured in:
Choice1	Nanometers
Choice2	Micrometers
Choice3	Inches or millimeters
Choice4	Angstroms

Inspector of Factories (Chemical) 110	In a cyclone separator used for separation of solid particles from a dust-laden gas, the separation factor is defined as the ratio of the centrifugal force to the gravitational force acting on the particle. S denotes the separation factor at a location (near the wall) that is at a radial distance, r from the center of the cyclone. Which one of the following statements is INCORRECT?
Choice1	S depends on mass of the particle
Choice2	S depends on the acceleration due to gravity
Choice3	S depends on tangitional velocity of the particle
Choice4	S depends on the radius location (r) of the particle
Inspector of Factories (Chemical) 111	At the end of the project life, the recovery of working capital for an industrial operation neglecting the time value of money provides:
Choice1	Negative Cash Flow
Choice2	Positive Cash Flow
Choice3	Zero Cash Flow
Choice4	No Cash Flow
Inspector of Factories (Chemical) 112	The future worth in the terms of present worth, nominal interest rate and number of years is given by:
Choice1	$F = P \cdot e^{(r \cdot N)}$
Choice2	$F = P \cdot e^{(-r \cdot N)}$
Choice3	$F = \frac{e^{(r \cdot N)}}{P}$
Choice4	$F = \frac{P}{e^{(-r \cdot N)}}$
Inspector of Factories (Chemical) 113	According to design consideration for shell and tube heat exchangers, where should a more viscous fluid generally be allocated to obtain a higher heat transfer coefficient?
Choice1	Tube side, because tube side coefficient is always higher.
Choice2	Shell side, because turbulence can provide a higher heat transfer coefficient.

Choice3	Either side, as viscosity doesn't affect the heat transfer coefficient.
Choice4	Tube side, because it always gives lower pressure drop.
Inspector of Factories (Chemical) 114	A 25% cut segmental baffle has a baffle height equal to approximately:
Choice1	25% of shell diameter
Choice2	50% of shell diameter
Choice3	75% of shell diameter
Choice4	100% of shell diameter
Inspector of Factories (Chemical) 115	Gross profit is equal to total revenue minus:
Choice1	Income tax.
Choice2	Total production cost.
Choice3	Fixed investment.
Choice4	Depreciation cost.
Inspector of Factories (Chemical) 116	A chemical plant has a fixed cost of **₹12,00,000 per year**. The selling price of the product is **₹800 per unit**, while the variable cost is **₹500 per unit**. The break-even production (units/year) is:
Choice1	3000
Choice2	4000
Choice3	5000
Choice4	6000
Inspector of Factories (Chemical) 117	For a thin cylindrical shell pressure vessel subjected to internal pressure, the hoop stress is given by: Where, P = Internal Pressure D = Internal Diameter t = Shell thickness

Choice1	$\sigma_h = \frac{PD}{2t}$
Choice2	$\sigma_h = \frac{PD}{4t}$
Choice3	$\sigma_h = \frac{2PD}{t}$
Choice4	$\sigma_h = \frac{PD}{8t}$
Inspector of Factories (Chemical) 118	Which depreciation method assumes equal depreciation every year?
Choice1	Double declining balance
Choice2	Straight line
Choice3	Sum of years digits
Choice4	MACRS
Inspector of Factories (Chemical) 119	According to the law of demand, when the price of a commodity increases, demand generally:
Choice1	Increases
Choice2	Remains constant
Choice3	Decreases
Choice4	Becomes infinite
Inspector of Factories (Chemical) 120	The principal mode of failure of a thin cylindrical shell subjected to external pressure is:
Choice1	Tensile failure
Choice2	Plastic deformation
Choice3	Buckling (collapse)
Choice4	Fatigue cracking
Inspector of Factories (Chemical) 121	What is a major advantage of the continuous hydrolysis and saponification process over the batch saponification process?

Choice1	Lower glycerin yield
Choice2	Higher glycerin yield
Choice3	Greater color formation
Choice4	Higher manpower requirement.
Inspector of Factories (Chemical) 122	For the manufacture of methanol by catalytic hydrogenation of carbon monoxide, the minimum theoretical molar ratio H_2/CO must be:
Choice1	1:2
Choice2	3:1
Choice3	2:1
Choice4	4:1
Inspector of Factories (Chemical) 123	According to thermodynamic equilibrium considerations (ignoring reaction kinetics), which combination of operating conditions most favours ammonia formation in the Haber–Bosch reaction?
Choice1	The reaction is favored at high temperature and low pressure.
Choice2	The reaction is favored at high pressure and high temperature.
Choice3	The reaction is favored at high pressure and low temperature.
Choice4	The reaction is favored at low pressure and low temperature.
Inspector of Factories (Chemical) 124	A cement manufacturer converts a wet-process plant to a modern dry-process plant with a preheater and precalciner. Which of the following changes is expected?
Choice1	Increase in kiln length and fuel consumption
Choice2	Decrease in kiln length and specific fuel consumption
Choice3	Increase in slurry moisture content
Choice4	Decrease in clinker production rate

Inspector of Factories (Chemical) 125	The softening point of normal PVC generally lies between:
Choice1	20 - 60°C
Choice2	50 - 80°C
Choice3	80 - 140°C
Choice4	150 - 200°C
Inspector of Factories (Chemical) 126	According to ASTM D 93, the Pensky-Martens Closed Cup test is used to determine the flash point of petroleum products over which temperature range?
Choice1	0 to 100°C
Choice2	40 to 360°C
Choice3	100 to 500°C
Choice4	20 to 200°C
Inspector of Factories (Chemical) 127	During preparation of fiber suspension for paper making, pulp is typically water-slurried to fiber content of:
Choice1	$\frac{1}{2} - \frac{3}{4}\,\%$
Choice2	$1\frac{1}{2} - 3\%$
Choice3	5 - 10 %
Choice4	10 - 15 %
Inspector of Factories (Chemical) 128	A crude oil sample has a relatively higher concentration of paraffins. Which property is most likely to be observed?
Choice1	lower viscosity than aromatic crude oils
Choice2	Higher viscosity than aromatic and naphthenic crude oils
Choice3	lower pour point than aromatic crude oils
Choice4	No relationship exists between paraffin content and viscosity

Inspector of Factories (Chemical) 129	A process engineer increases the hydrogen concentration in an HDPE slurry loop reactor using a Phillips catalyst while maintaining all other operating conditions. Which outcome is **most likely**?
Choice1	Decreased polymer molecular weight and melt viscosity, although the magnitude of the response depends on the catalyst formulation.
Choice2	Increased molecular weight because hydrogen inhibits chain transfer.
Choice3	Increased polymer density due solely to hydrogen incorporation into the polymer backbone.
Choice4	No measurable effect because hydrogen is chemically inert under polymerization conditions.
Inspector of Factories (Chemical) 130	In the industrial manufacture of urea, ammonia, and carbon dioxide, first react to form:
Choice1	Ammonium Nitrate
Choice2	Ammonium Sulfate
Choice3	Ammonium Carbamate
Choice4	Biuret
Inspector of Factories (Chemical) 131	The Standard Oil Company (Indiana) process for polyethylene production is typically carried out at:
Choice1	130 - 160 °C and 10-20 atm
Choice2	230 - 270 °C and 40-80 atm
Choice3	90 - 100 °C and 100-150 atm
Choice4	80 - 120 °C and 1000-3000 atm
Inspector of Factories (Chemical) 132	Mixed fertilizers contain which three primary plant nutrients?
Choice1	Nitrogen, Sulfur, and Calcium
Choice2	Nitrogen, Phosphorus, and Potassium
Choice3	Phosphorus, Calcium, and Magnesium

Choice4	Potassium, Sulfur, and Zinc
Inspector of Factories (Chemical) 133	Selective acetylene hydrogenation reactor in an ethylene plant is bypassed due to maintenance. What is the most likely consequence?
Choice1	Higher polymer-grade ethylene purity
Choice2	Increased acetylene concentration in the ethylene product, making it unsuitable for polymerization
Choice3	Increased ethane conversion
Choice4	Reduced refrigeration duty
Inspector of Factories (Chemical) 134	Which ONE of the following process sequence is used in the sugar industry?
Choice1	$CaHPO_4$/Lime treatment → Multiple stage evaporation → Crystallization
Choice2	Crushing → Crystallization → $CaHPO_4$/Lime treatment
Choice3	$CaHPO_4$/Lime treatment → Crystallization → Crushing
Choice4	Multiple stage evaporation → Crystallization → Ca_2HPO_4/Lime treatment
Inspector of Factories (Chemical) 135	In the Stengel process, ammonia vapor is preheated at approximately:
Choice1	80 - 90°C
Choice2	100 - 110°C
Choice3	140 - 150°C
Choice4	200 - 220°C
Inspector of Factories (Chemical) 136	When environmental lapse rate exceeds the adiabatic lapse rate, then the atmosphere is:
Choice1	Stable
Choice2	Neutral
Choice3	Unstable

Choice4	Inversion
Inspector of Factories (Chemical) 137	Which of the following oxidants has the highest oxidation potential under acidic conditions?
Choice1	Chlorine
Choice2	Hydrogen peroxide
Choice3	O_3
Choice4	O_2
Inspector of Factories (Chemical) 138	A worker is exposed to 30 ppm of CO for a sufficiently long period to attain equilibrium. The approximate percentage of carboxyhemoglobin in blood is:
Choice1	2.3%
Choice2	4.5%
Choice3	5.3%
Choice4	6.8%
Inspector of Factories (Chemical) 139	Which instrument is commonly used to determine the ambient lapse rate?
Choice1	Hygrometer
Choice2	Barometer
Choice3	Anemometer
Choice4	Thermometer equipped with balloon
Inspector of Factories (Chemical) 140	Assertion (A): Alkalinity is commonly reported as mg/l as $CaCO_3$. Reason (R): One milliequivalent of $CaCO_3$ is equal to 50 mg.
Choice1	Both A and R are true, and R is the correct explanation of A.
Choice2	Both A and R are true, but R is not the correct explanation of A.
Choice3	A is true, but R is false.

Choice4	A is false, but R is true.
Inspector of Factories (Chemical) 141	What is the primary cause of a radiation (nocturnal) inversion?
Choice1	Radiational cooling of the ground at night, cools the air near the surface.
Choice2	Strong solar heating of the ground during the day.
Choice3	Mixing of warm and cold air by strong winds.
Choice4	Advection of warm air over a cold ocean.
Inspector of Factories (Chemical) 142	Plume rise above the physical stack height is caused by which two effects?
Choice1	Atmospheric stability or wind speed
Choice2	Lower density that the surrounding air or higher momentum of gas mixture the stack.
Choice3	Stack height or atmospheric pressure difference
Choice4	Solar radiation and turbulent diffusion.
Inspector of Factories (Chemical) 143	Three wastewater samples have the following BOD/COD ratios: Sample P = 0.25, Sample Q = 0.55, Sample R = 0.75. Which sample is expected to contain the highest proportion of biologically resistant organic matter?
Choice1	Sample P
Choice2	Sample Q
Choice3	Sample R
Choice4	All three have equal biodegradability
Inspector of Factories (Chemical) 144	Which of the following statements correctly distinguishes adsorption from absorption?
Choice1	Adsorption is the accumulation of molecules on the solid surface, whereas absorption involves the penetration of molecules into the bulk of material.

Choice2	Adsorption involves the penetration of molecules into the bulk of a material, whereas absorption occurs only on the surface.
Choice3	Both adsorption and absorption involve the penetration of molecules into the bulk of the material.
Choice4	Both adsorption and absorption occur only at the surface of the material.
Inspector of Factories (Chemical) 145	Which one of the following pollutants contributes simultaneously to **acid rain, formation of fine particulate matter ($PM_{2.5}$)** and **reduction in atmospheric visibility**?
Choice1	Carbon monoxide (CO)
Choice2	Sulphur dioxide (SO_2)
Choice3	Methane (CH_4)
Choice4	Ammonia (NH_3)
Inspector of Factories (Chemical) 146	Under which atmospheric condition, the ground-level concentration of pollutants near an emission source is generally the highest, assuming identical stack height and emission rate?
Choice1	Highly unstable atmosphere (Class A)
Choice2	Neutral atmosphere (Class D)
Choice3	Highly stable atmosphere (Class F)
Choice4	Slightly unstable atmosphere (Class C)
Inspector of Factories (Chemical) 147	The fundamental principle of membrane separation is based on:
Choice1	Differences in the transport rates of components through a selective barrier.
Choice2	Differences in boiling points of the components.
Choice3	Differences in the densities of the components.
Choice4	Differences in the sedimentation velocities of the components.

Inspector of Factories (Chemical) 148	Which plume type generally produces the **lowest ground-level pollutant concentration** in the vicinity of a stack?
Choice1	Fanning plume
Choice2	Looping plume
Choice3	Lofting plume
Choice4	Fumigation plume
Inspector of Factories (Chemical) 149	The **Dry Adiabatic Lapse Rate (DALR)** is approximately equal to:
Choice1	4.5°C/km
Choice2	6.5°C/km
Choice3	9.8°C/km
Choice4	12.5°C/km
Inspector of Factories (Chemical) 150	Photochemical smog is primarily produced by the reaction of nitrogen oxides ($\mathrm{NO_x}$) and hydrocarbons in the presence of sunlight. Which one of the following compounds is **NOT** considered a major constituent of photochemical smog?
Choice1	Ozone (O_3)
Choice2	Peroxyacetyl nitrate (PAN)
Choice3	Aldehydes
Choice4	Sulphur dioxide (SO_2)