



GATE 2022 General Aptitude (GA)

Q.1 – Q.5 Carry ONE mark each.

Q.1	Inhaling the smoke from a burning could you quickly.
(A)	tire / tier
(B)	tire / tyre
(C)	tyre / tire
(D)	tyre / tier

Q.2	A sphere of radius r cm is packed in a box of cubical shape. What should be the minimum volume (in cm ³) of the box that can enclose the
	sphere?
(A)	$\frac{r^3}{8}$
(B)	r ³
(C)	2r ³
(D)	8r ³

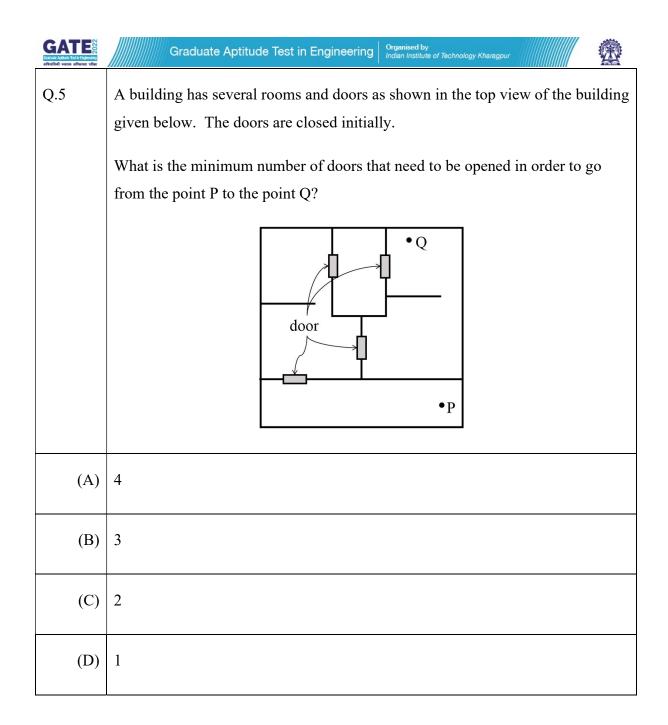
GATE हारप्रायर म्रह्मार्थ अपनिकार अभियरिकी भनातक अभिवाशा सीका	Graduate Aptitude Test in Engineering Organised by Indian Institute of Technology Kharagpur
Q.3	Pipes P and Q can fill a storage tank in full with water in 10 and 6 minutes, respectively. Pipe R draws the water out from the storage tank at a rate of 34 litres per minute. P, Q and R operate at a constant rate.If it takes one hour to completely empty a full storage tank with all the pipes operating simultaneously, what is the capacity of the storage tank (in litres)?
(A)	26.8
(B)	60.0
(C)	120.0
(D)	127.5





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Q.4	Six persons P, Q, R, S, T and U are sitting around a circular table facing the center not necessarily in the same order. Consider the following statements:
	 P sits next to S and T. Q sits diametrically opposite to P. The shortest distance between S and R is equal to the shortest distance between T and U. Based on the above statements, Q is a neighbor of
(A)	U and S
(B)	R and T
(C)	R and U
(D)	P and S







Q. 6 – Q. 10 Carry TWO marks each.

Q.6	Rice, a versatile and inexpensive source of carbohydrate, is a critical component of diet worldwide. Climate change, causing extreme weather, poses a threat to sustained availability of rice. Scientists are working on developing Green Super Rice (GSR), which is resilient under extreme weather conditions yet gives higher yields sustainably. Which one of the following is the CORRECT logical inference based on the information given in the above passage?
(A)	GSR is an alternative to regular rice, but it grows only in an extreme weather
(B)	GSR may be used in future in response to adverse effects of climate change
(C)	GSR grows in an extreme weather, but the quantity of produce is lesser than regular rice
(D)	Regular rice will continue to provide good yields even in extreme weather





A game consists of spinning an arrow around a stationary disk as shown below. Q.7 When the arrow comes to rest, there are eight equally likely outcomes. It could come to rest in any one of the sectors numbered 1, 2, 3, 4, 5, 6, 7 or 8 as shown. Two such disks are used in a game where their arrows are independently spun. What is the probability that the sum of the numbers on the resulting sectors upon spinning the two disks is equal to 8 after the arrows come to rest? 1 1 8 8 7 7 2 2 6 3 6 3 4 5 4 5 $\frac{1}{16}$ (A) 5 64 (B) 3 32 (C) $\frac{7}{64}$ (D)



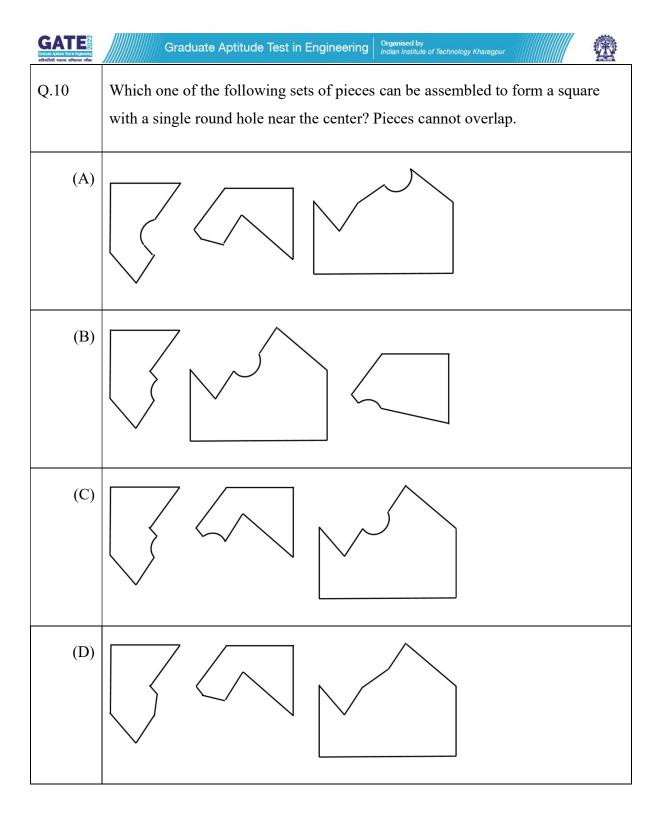


Q.8	Consider the following inequalities.
	(i) $3p - q < 4$
	(ii) $3q - p < 12$
	Which one of the following expressions below satisfies the above two
	inequalities?
(A)	p+q<8
(B)	p + q = 8
(C)	$8 \le p + q < 16$
(D)	$p + q \ge 16$





Q.9	Given below are three statements and four conclusions drawn based on the statements.
	Statement 1: Some engineers are writers.
	Statement 2: No writer is an actor.
	Statement 3: All actors are engineers.
	Conclusion I: Some writers are engineers.
	Conclusion II: All engineers are actors.
	Conclusion III: No actor is a writer.
	Conclusion IV: Some actors are writers.
	Which one of the following options can be logically inferred?
(A)	Only conclusion I is correct
(B)	Only conclusion II and conclusion III are correct
(C)	Only conclusion I and conclusion III are correct
(D)	Either conclusion III or conclusion IV is correct







Q.11 – Q.35 Carry ONE mark Each

Q.11	The value of $(1 + i)^{12}$, where $i = \sqrt{-1}$, is
(A)	-64i
(B)	64 <i>i</i>
(C)	64
(D)	-64
Q.12	Given matrix $A = \begin{bmatrix} x & 1 & 3 \\ y & 2 & 6 \\ 3 & 5 & 7 \end{bmatrix}$, the ordered pair (x, y) for which det $(A) = 0$ is
(A)	(1,1)
(B)	(1,2)
(C)	(2,2)
(D)	(2,1)





Q.13	Let $f(x) = e^{- x }$, where x is real. The value of $\frac{df}{dx}$ at $x = -1$ is
(A)	-е
(B)	е
(C)	1/ _e
(D)	-1/e
Q.14	The value of the real variable $x \ge 0$, which maximizes the function
	$f(x) = x^e e^{-x} $ is
(A)	е
(B)	0
(C)	1/e
(D)	1



Q.15	For a single component system at vapor-liquid equilibrium, the extensive variables A, V, S and N denote the Helmholtz free energy, volume, entropy, and number of moles, respectively, in a given phase. If superscripts (v) and (l) denote the vapor and liquid phase, respectively, the relation that is NOT CORRECT is
(A)	$\left(\frac{\partial A^{(l)}}{\partial V^{(l)}}\right)_{T,N^{(l)}} = \left(\frac{\partial A^{(\nu)}}{\partial V^{(\nu)}}\right)_{T,N^{(\nu)}}$
(B)	$\left(\frac{\partial A^{(l)}}{\partial N^{(l)}}\right)_{T,V^{(l)}} = \left(\frac{\partial A^{(v)}}{\partial N^{(v)}}\right)_{T,V^{(v)}}$
(C)	$\left(\frac{A+PV}{N}\right)^{(l)} = \left(\frac{A+PV}{N}\right)^{(v)}$
(D)	$\left(\frac{A+TS}{N}\right)^{(l)} = \left(\frac{A+TS}{N}\right)^{(\nu)}$
Q.16	Consider turbulent flow in a pipe under isothermal conditions. Let r denote the radial coordinate and z denote the axial flow direction. On moving away from the wall towards the center of the pipe, the rz -component of the Reynolds stress
(A)	Increases and then decreases
(B)	Decreases and then increases
(C)	Remains unchanged
(D)	Only increases





Q.17	Consider two stationary spherical pure water droplets of diameters d_1 and $2d_1$. CO ₂ diffuses into the droplets from the surroundings. If the rate of diffusion of CO ₂ into the smaller droplet is W_1 mol s ⁻¹ , the rate of diffusion of CO ₂ into the larger droplet is
(A)	2W ₁
(B)	4W ₁
(C)	W_1
(D)	0.5W ₁
Q.18	In soap manufacturing, the triglycerides present in oils and fats are hydrolyzed to mainly produce
(A)	Fatty acids and glycerol
(B)	Glycerol only
(C)	Fatty acids only
(D)	Glycerol and paraffins





Q.19	The chemical formula of Glauber's salt, used in the Kraft process, is
(A)	Na ₂ CO ₃ .10H ₂ O
(B)	Na ₂ S ₂ O ₄ .2H ₂ O
(C)	Na ₂ HPO ₄ .2H ₂ O
(D)	Na ₂ SO ₄ .10H ₂ O
Q.20	Catalytic reforming is commonly used in the petroleum industry to improve fuel quality. The undesirable reaction in the catalytic reforming of naphtha is
Q.20	
Q.20 (A)	
	quality. The undesirable reaction in the catalytic reforming of naphtha is
(A)	quality. The undesirable reaction in the catalytic reforming of naphtha is Hydrocracking of paraffins
(A) (B)	quality. The undesirable reaction in the catalytic reforming of naphtha is Hydrocracking of paraffins Dehydrogenation of naphthenes

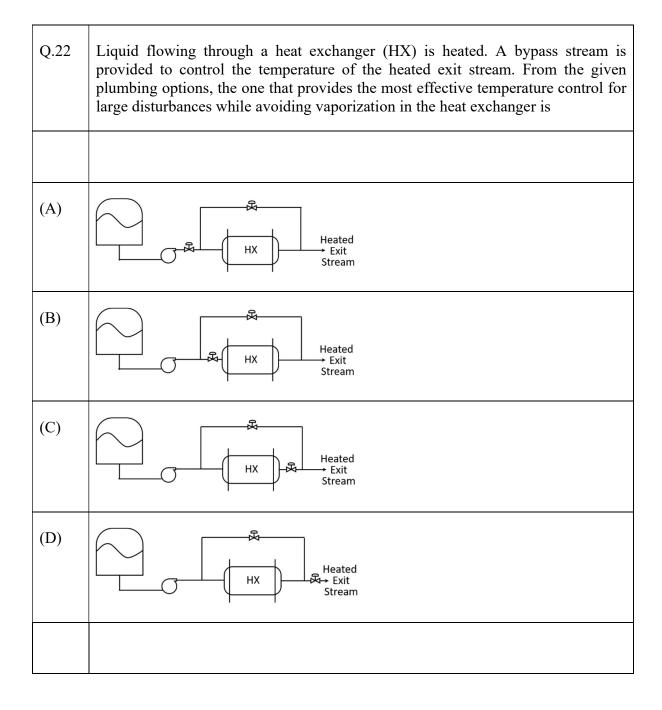




Q.21 A control system on the jacket side of a reactor is shown in the figure. Pressurized water flows through the jacket to cool the reactor. The heated water flashes in the boiler. The exothermic reaction heat thus generates steam. Fresh boiler feed water (BFW) is added to make-up for the loss of water as steam. Assume that all control valves are air-to-open. The controller action, 'direct' or 'reverse', is defined with respect to the controller. Select the option that correctly specifies the action of the controllers. (тс setpoint Steam Boiler PRV BFW Jacketed Reactor LC: Level Controller PC: Pressure Controller TC: Temperature Controller **PRV: Pressure Reducing Valve** (A) PC: Reverse, LC: Direct, TC: Reverse PC: Direct, LC: Reverse, TC: Direct (B) PC: Direct, LC: Reverse, TC: Reverse (C) (D) PC: Reverse, LC: Direct, TC: Direct

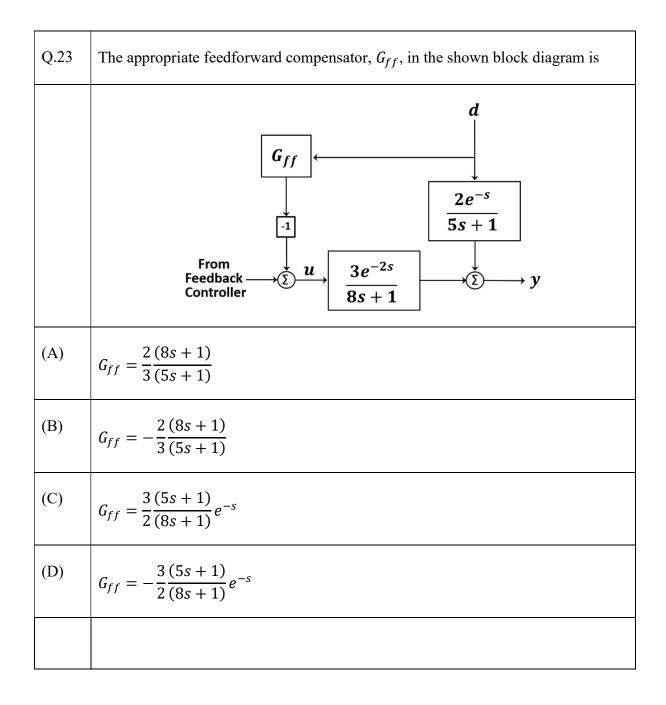














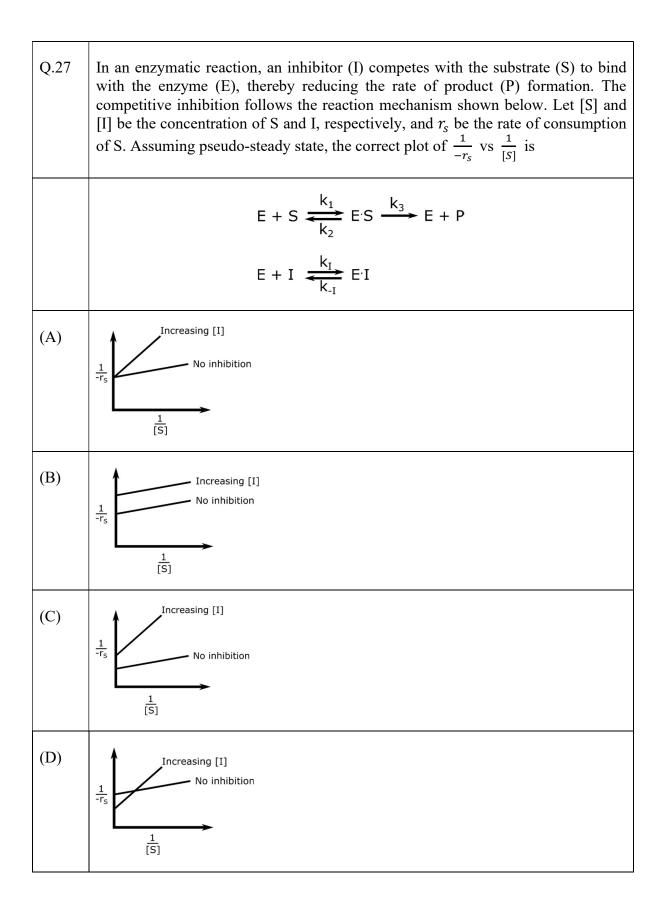


Q.24			tion that correctly pairs the measure.	ne given meas	surement devices with
		S No	Measurement Device	S No	Measured Quantity
		Ι	Bourdon Gauge	А	Temperature
		II	Orifice Plate meter	В	Concentration
		III	Pyrometer	С	Pressure
		IV	Colorimeter	D	Flow rate
	-	V	Pirani Gauge	E	Liquid level
(A)	I-E II-C	C III-D) IV-B V-A		
(B)	I-C II-I	D III-A	A IV-B V-C		
(C)	I-C II-I	D III-E	E IV-A V-D		
(D)	I-D II-0	C III-A	A IV-E V-C		



Q.25	A simple distillation column is designed to separate an ideal binary mixture to specified distillate and bottoms purities at a given column pressure. If RR _{min} is the minimum reflux ratio for this separation, select the statement that is NOT CORRECT with regard to the variation in the total annualized cost (TAC) of the column with reflux ratio (RR).
(A)	TAC has a minimum with respect to RR
(B)	The sharpest rise in TAC occurs as RR approaches RR _{min} from above
(C)	The sharpest decrease in TAC occurs as RR approaches RR_{min} from above
(D)	TAC increases with RR for $RR >> RR_{min}$
Q.26	The reaction $A \rightarrow B$ is carried out isothermally on a porous catalyst. The intrinsic reaction rate is kC_A^2 , where k is the rate constant and C_A is the concentration of A. If the reaction is strongly pore-diffusion controlled, the observed order of the reaction is
(A)	1
(B)	2
(C)	3/2
(D)	$\sqrt{2}$









Q.28	The area of a circular field is 25 m ² . The radius, r , is to be determined using the Newton-Raphson iterative method. For an initial guess of $r = 2.500$ m, the revised estimate of r after one iteration is m (rounded off to three decimal places).
Q.29	5 moles of liquid benzene, 8 moles of liquid toluene and 7 moles of liquid xylene are mixed at 25 °C and 1 bar. Assuming the formation of an ideal solution and using the universal gas constant $R = 8.314$ J mol ⁻¹ K ⁻¹ , the total entropy change is J K ⁻¹ (rounded off to one decimal place).
Q.30	A perfectly insulated double pipe heat exchanger is operating at steady state. Saturated steam enters the inner pipe at 100 °C and leaves as saturated water at 100 °C. Cooling water enters the outer pipe at 75 °C and exits at 95 °C. The overall heat transfer coefficient is 1 kW m ⁻² K ⁻¹ and the heat transfer area is 1 m ² . The average specific heat capacity of water at constant pressure is 4.2 kJ kg ⁻¹ K ⁻¹ . The required cooling water flow rate is kg s ⁻¹ (rounded off to two decimal places).
Q.31	Consider steady-state diffusion in a binary <i>A-B</i> liquid at constant temperature and pressure. The mole-fraction of <i>A</i> at two different locations is 0.8 and 0.1. Let N_{A1} be the diffusive flux of <i>A</i> calculated assuming <i>B</i> to be non-diffusing, and N_{A2} be the diffusive flux of <i>A</i> calculated assuming equimolar counter-diffusion. The quantity $\frac{(N_{A1}-N_{A2})}{N_{A1}} \times 100 \text{ is} \(\text{rounded off to one decimal place}).$







Q.32	Consider interphase mass transfer of a species <i>S</i> between two immiscible liquids <i>A</i> and <i>B</i> . The interfacial mass transfer coefficient of <i>S</i> in liquid <i>A</i> is twice of that in liquid <i>B</i> . The equilibrium distribution of <i>S</i> between the liquids is given by $y_S^A = 0.5y_S^B$, where y_S^A and y_S^B are the mole-fractions of <i>S</i> in <i>A</i> and <i>B</i> , respectively. The bulk phase mole-fraction of <i>S</i> in <i>A</i> and <i>B</i> is 0.10 and 0.02, respectively. If the steady-state flux of <i>S</i> is estimated to be 10 kmol h ⁻¹ m ⁻² , the mass transfer coefficient of <i>S</i> in <i>A</i> is kmol h ⁻¹ m ⁻² (rounded off to one decimal place).
Q.33	A wet solid containing 20% (w/w) moisture (based on mass of bone-dry solid) is dried in a tray-dryer. The critical moisture content of the solid is 10% (w/w). The drying rate (kg m ⁻² s ⁻¹) is constant for the first 4 hours, and then decreases linearly to half the initial value in the next 1 hour. At the end of 5 hours of drying, the percentage moisture content of the solid is% (w/w) (rounded off to one decimal place).
Q.34	A process described by the transfer function
	$G_p(s) = \frac{(10s+1)}{(5s+1)}$ is forced by a unit step input at time $t = 0$. The output value immediately after the step input (at $t = 0^+$) is (rounded off to the nearest integer).





Q.35	A compressor with a life of 10 years costs Rs 10 lakhs. Its yearly operating cost is Rs 0.5 lakh. If the annual compound interest rate is 8%, the amount needed at present to fund perpetual operation of the compressor is Rs lakhs (rounded to first decimal place).

GATE 2022 Chemical Engineering (CH)

GATE

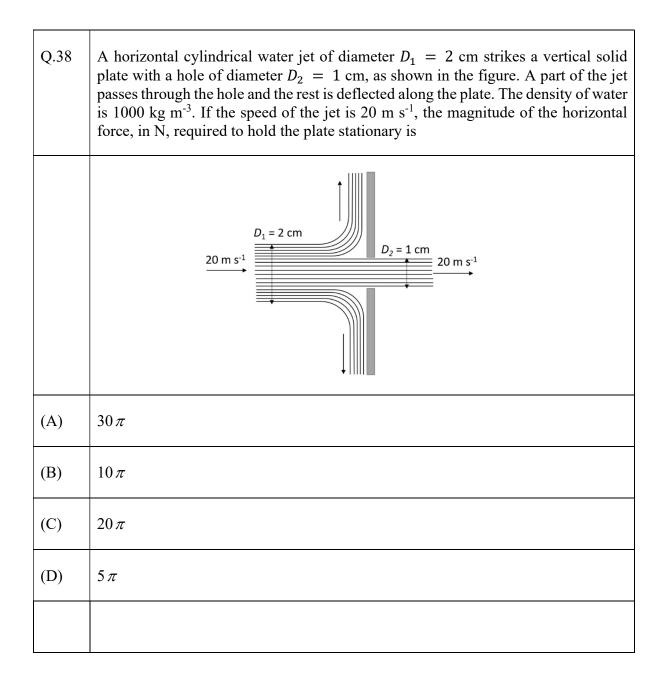
Q.36 – Q.65 Carry TWO marks Each

Q.36	The partial differential equation		
	$\frac{\partial u}{\partial t} = \frac{1}{\pi^2} \frac{\partial^2 u}{\partial x^2}$		
	where, $t \ge 0$ and $x \in [0,1]$, is subjected to the following initial and boundary conditions:		
	$u(x,0) = \sin\left(\pi x\right)$		
	u(0,t)=0		
	u(1,t)=0		
	The value of t at which $\frac{u(0.5,t)}{u(0.5,0)} = \frac{1}{e}$ is		
(A)	1		
(B)	e		
(C)	π		
(D)	$^{1}/_{e}$		



Q.37	<i>N</i> moles of an ideal gas undergo a two-step process as shown in the figure. Let <i>P</i> , <i>V</i> and <i>T</i> denote the pressure, volume and temperature of the gas, respectively. The gas, initially at state-1 (P_1 , V_1 , T_1), undergoes an isochoric (constant volume) process to reach state-A, and then undergoes an isobaric (constant pressure) expansion to reach state-2 (P_2 , V_2 , T_2). For an ideal gas, $C_P - C_V = NR$, where C_P and C_V are the heat capacities at constant pressure and constant volume, respectively, and assumed to be temperature independent. The heat gained by the gas in the two-step process is given by		
	$ \begin{array}{c} $		
(A)	$P_2(V_2 - V_1) + C_V(T_2 - T_1)$		
(B)	$P_2(V_2 - V_1) + C_P(T_2 - T_1)$		
(C)	$C_P(T_2 - T_1) + C_V(T_2 - T_1)$		
(D)	$P_2V_2 - P_1V_1$		







Q.39	Consider a horizontal rod of radius aR ($a < 1$) in a stationary pipe of radius R . The rod is pulled coaxially at a constant velocity V as shown in the figure. The annular region is filled with a Newtonian incompressible fluid of viscosity μ . The steady state fully developed axial velocity profile in the fluid is given by $u(r) = V \frac{\ln(r/R)}{\ln(a)}$, where r is the radial coordinate. Ignoring end effects, the magnitude of the pulling force per unit rod length is
(A)	πμV
(B)	$-\frac{2\pi\mu V}{\ln(a)}$
(C)	0
(D)	$-\frac{\pi\mu V}{\ln(a)}$





Q.40	Consider a bare long copper wire of 1 mm diameter. Its surface temperature is T_s and the ambient temperature is T_a ($T_s > T_a$). The wire is to be coated with a 2 mm thick insulation. The convective heat transfer coefficient is 20 W m ⁻² K ⁻¹ . Assume that T_s and T_a remain unchanged. To reduce heat loss from the wire, the maximum allowed thermal conductivity of the insulating material, in W m ⁻¹ K ⁻¹ , rounded off to two decimal places, is
(A)	0.02
(B)	0.04
(C)	0.10
(D)	0.01
Q.41	Two large parallel planar walls are maintained at 1000 K and 500 K. Parallel radiation shields are to be installed between the two walls. Assume that the emissivities of the walls and the shields are equal. If the melting temperature of the shields is 900 K, the maximum number of shield(s) that can be installed between the walls is (are)
(A)	1
(B)	0
(C)	2
(D)	3





Q.42	Saturated steam condenses on a vertical plate maintained at a constant wall temperature. If x is the vertical distance from the top edge of the plate, then the local heat transfer coefficient $h(x) \propto \Gamma(x)^{-1/3}$, where $\Gamma(x)$ is the local mass flow rate of the condensate per unit plate width. The ratio of the average heat transfer coefficient over the entire plate to the heat transfer coefficient at the bottom of the plate is
(A)	4
(B)	4/3
(C)	3/4
(D)	3

Q.43	Match the product in Group-1 with the manufacturing process in Group-2. The correct combination is		
	Group-1	Group-2	
	P Nitric acid	I Trona process	
	Q Phosphoric acid	II Twitchell process	
	R Potassium chloride	III Ostwald's process	
	S Stearic acid	IV Haifa process	
(A)	P-III, Q-I, R-IV, S-II		
(B)	P-IV, Q-I, R-II, S-III		
(C)	P-III, Q-IV, R-I, S-II		
(D)	P-I, Q-IV, R-II, S-III		

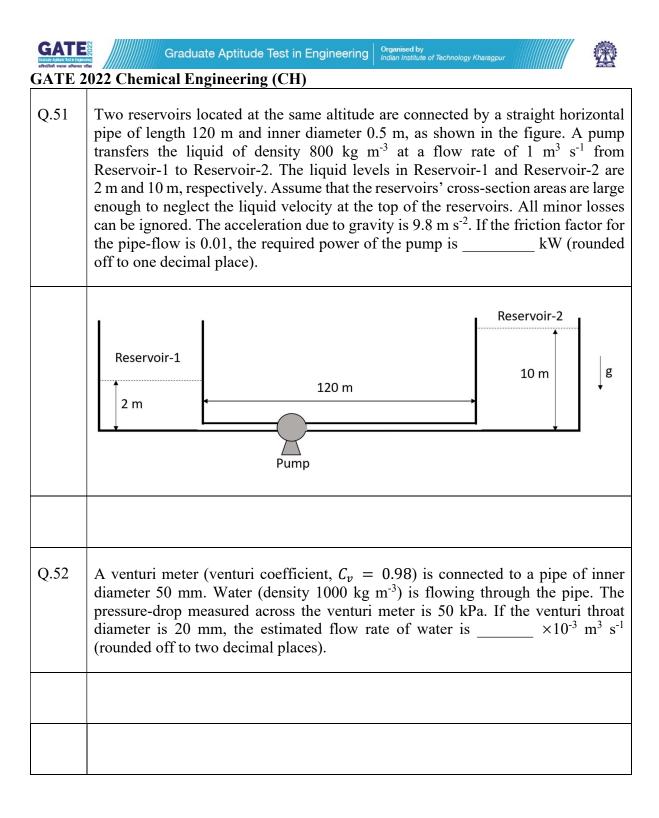




	2022 Chemical Engineering (CH)
Q.44	The directional derivative of $f(x, y, z) = 4x^2 + 2y^2 + z^2$ at the point (1,1,1) in the direction of the vector $\vec{v} = \hat{i} - \hat{k}$ is (rounded off to two decimal places).
Q.45	Consider a sphere of radius 4, centered at the origin, with outward unit normal \hat{n} on its surface S. The value of the surface integral $\iint_{S} \left(\frac{2x\hat{i} + 3y\hat{j} + 4z\hat{k}}{4\pi} \right) \hat{n} dA$ is (rounded off to one decimal place).
Q.46	The equation $\frac{dy}{dx} = xy^2 + 2y + x - 4.5$ with the initial condition $y(x=0)=1$ is to be solved using a predictor-corrector approach. Use a predictor based on the implicit Euler's method and a corrector based on the trapezoidal rule of integration, each with a full-step size of 0.5. Considering only positive values of y, the value of y at x = 0.5 is (rounded off to three decimal places).

	Graduate Aptitude Test in Engineering Organised by Indian Institute of Technology Kharagpur
GATE 2	022 Chemical Engineering (CH)
Q.47	A substance at 4 °C has a thermal expansion coefficient $\beta = \frac{1}{v} \left(\frac{\partial v}{\partial T}\right)_P = 0$ K ⁻¹ , an isothermal compressibility, $\kappa_T = -\frac{1}{v} \left(\frac{\partial v}{\partial P}\right)_T = 5 \times 10^{-4}$ Pa ⁻¹ and a molar volume $v = 18 \times 10^{-6}$ m ³ mol ⁻¹ . If <i>s</i> is the molar entropy, then at 4 °C, the quantity $\left[v \left(\frac{\partial s}{\partial v}\right)_T\right]$ evaluated for the substance is J mol ⁻¹ K ⁻¹ (rounded off to the nearest integer).
Q.48	The molar excess Gibbs free energy (g^E) of a liquid mixture of A and B is given by $\frac{g^E}{RT} = x_A x_B [C_1 + C_2 (x_A - x_B)]$ where x_A and x_B are the mole fraction of A and B , respectively, the universal gas constant, $R = 8.314$ J K ⁻¹ mol ⁻¹ , T is the temperature in K, and C_1, C_2 are temperature-dependent parameters. At 300 K, $C_1 = 0.45$ and $C_2 = -0.018$. If γ_A and γ_B are the activity coefficients of A and B , respectively, the value of $\int_0^1 \ln\left(\frac{\gamma_A}{\gamma_B}\right) dx_A$ at 300 K and 1 bar is (rounded off to the nearest integer).

	Graduate Aptitude Test in E	ngineering Organ	nised by Institute of Technology Kharagpur					
GATE 2	022 Chemical Engineering (CH)							
Q.49	For a pure substance, the following data at saturated conditions are given:							
Q.49	ln P ^{sat} (bar)	Т (К)					
	0.693		350					
	1.386		370					
	Assume that the vapor phase behaves ideally, the molar volume of the liquid is negligible, and the latent heat of vaporization is constant over the given temperature range. The universal gas constant, $R = 8.314$ J K ⁻¹ mol ⁻¹ . From the above data, the estimated latent heat of vaporization at 360 K is kJ/mol (rounded off to one decimal place).							
Q.50	Consider the process flowsheet in the figure. An irreversible liquid-phase reaction $A \rightarrow B$ (reaction rate $-r_A = 164 x_A \text{ kmol m}^{-3} \text{ h}^{-1}$) occurs in a 1 m ³ continuous stirred tank reactor (CSTR), where x_A is the mole fraction of A. A small amount of inert, I, is added to the reactor. The reactor effluent is separated in a perfect splitter to recover pure B product down the bottoms and a B-free distillate. A fraction of the distillate is purged and the rest is recycled back to the reactor. At a particular steady state, the product rate is 100 kmol h ⁻¹ , the recycle rate is 200 kmol h ⁻¹ and the purge rate is 10 kmol h ⁻¹ . Given the above information, the inert feed rate into the process is kmol h ⁻¹ (rounded off to two decimal places).							
	Fresh A Inert / $-r_A = k x_A$ $k=164 \text{ kmol m}^{-3} \text{ h}^{-1}$	e, 200 kmol h ⁻¹	Purge, 10 kmol h ⁻¹ (No B)					





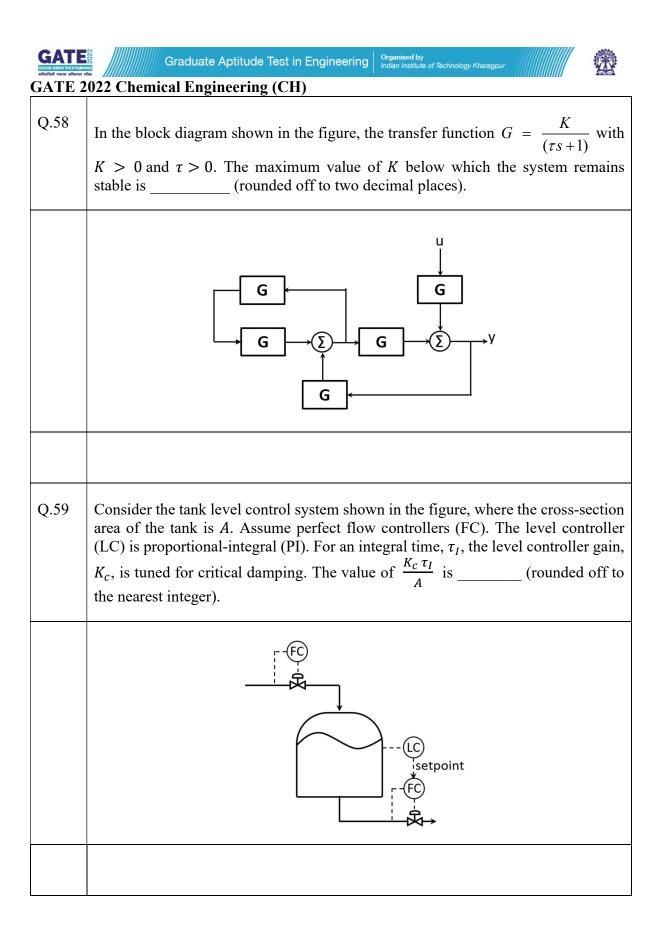


	022 Chemical Engineering (CH)
Q.53	In a constant-rate cake filtration operation, the collected filtrate volumes are 120 m^3 and 240 m^3 at 1 min and 2 min, respectively. Assume the cake resistance to be constant and the filter medium resistance to be negligible. If the pressure-drop across the cake is 10 kPa at 1 min, its value at 2 min is kPa (rounded off to the nearest integer).
Q.54	A cylindrical fin of diameter 24 mm is attached horizontally to a vertical planar wall. The heat transfer rate from the fin to the surrounding air is 60% of the heat transfer rate if the entire fin were at the wall temperature. If the fin effectiveness is 10, its length is mm (rounded off to the nearest integer).
Q.55	A single-effect evaporator with a heat transfer area of 70 m ² concentrates a salt solution using steam. The salt solution feed rate and temperature are 10000 kg h ⁻¹ and 40 °C, respectively. The saturated steam feed rate and temperature are 7500 kg h ⁻¹ and 150 °C, respectively. The boiling temperature of the solution in the evaporator is 80 °C. The average specific heat of the solution is 0.8 kcal kg ⁻¹ K ⁻¹ . The latent heat of vaporization is 500 kcal kg ⁻¹ . If the steam-economy is 0.8, the overall heat transfer coefficient is kcal h ⁻¹ m ⁻² K ⁻¹ (rounded off to the nearest integer).





GATE 2	2022 Chemical Engineering (CH)
Q.56	An equimolar binary mixture is to be separated in a simple tray-distillation column. The feed rate is 50 kmol min ⁻¹ . The mole fractions of the more volatile component in the top and bottom products are 0.90 and 0.01, respectively. The feed as well as the reflux stream are saturated liquids. On application of the McCabe-Thiele method, the operating line for the stripping section is obtained as
	y = 1.5x - 0.005
	where y and x are the mole fractions of the more volatile component in the vapor and liquid phases, respectively. The reflux ratio is (rounded off to two decimal places).
Q.57	The dry-bulb temperature of air in a room is 30 °C. The Antoine equation for water is given as
	$\ln P^{sat} = 12.00 - \frac{4000}{T - 40}$
	where <i>T</i> is the temperature in K and P^{sat} is the saturation vapor pressure in bar. The latent heat of vaporization of water is 2000 kJ kg ⁻¹ , the humid heat is 1.0 kJ kg ⁻¹ K ⁻¹ , and the molecular weights of air and water are 28 kg kmol ⁻¹ and 18 kg kmol ⁻¹ , respectively. If the absolute humidity of air is Y' kg moisture per kg dry air, then for a wet-bulb depression of 9 °C, $1000 \times Y' =$ (rounded off to one decimal place).



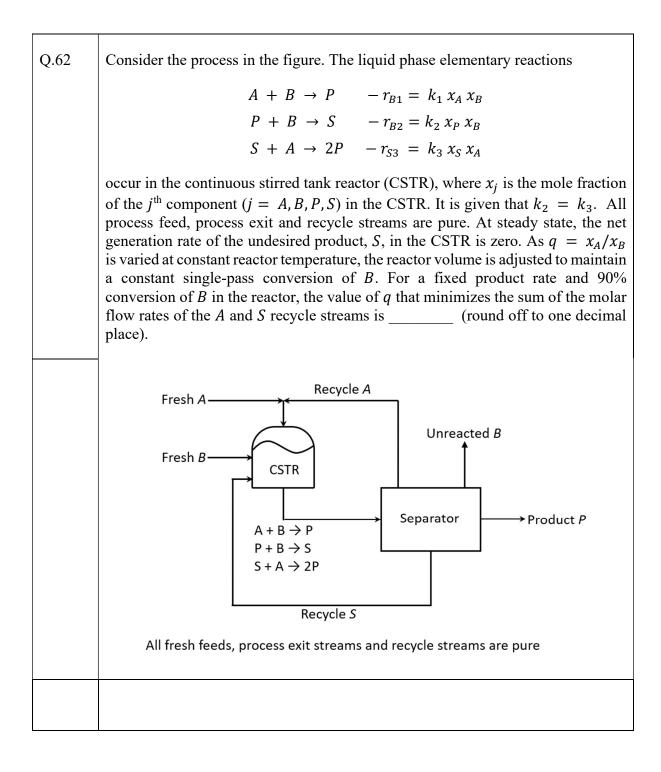


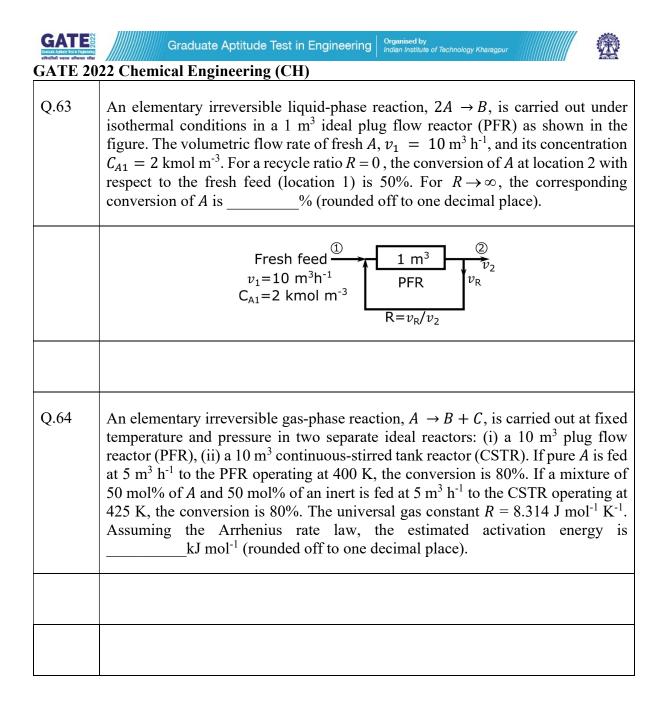


GATE	2022 Chemical Engineering (CH)					
Q.60	Consider a single-input-single-output (SISO) system with the transfer function					
	$G_{p}(s) = \frac{2(s+1)}{\left(\frac{1}{2}s+1\right)\left(\frac{1}{4}s+1\right)}$					
	where the time constants are in minutes. The system is forced by a unit step input at time $t = 0$. The time at which the output response reaches the maximum is minutes (rounded off to two decimal places).					
Q.61 Information for a proposed greenfield project is provided in the table. The cash flow for the fourth year is Rs crores (rounded off to place).						
	Fixed capital investment (excluding land) Rs 250 crores					
	Salvage value	Rs 0				
	Yearly revenue from product sales	Rs 120 crores				
	Yearly manufacturing cost (excluding depreciation)	Rs 30 crores				
	Interest rate	10% compounded annually				
	Annual taxation rate	30%				
	Depreciation method	Double declining balance [*] over seven years				
	Plant start-up	2 years after project initiation				
	* $d_k = \frac{2}{7}BV_{k-1}$ k: years post start-up d: Depr	eciation amount <i>BV</i> : Book value				



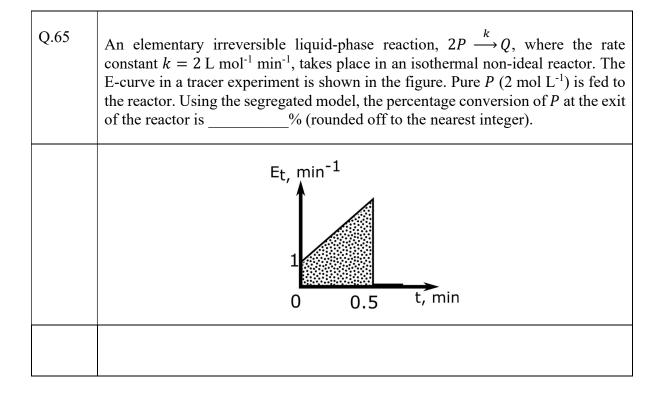
















Q. No.	Session	Question Type	Subject Name	Key/Range	Mark (MK)
1	4	MCQ	GA	С	1
2	4	MCQ	GA	D	1
3	4	MCQ	GA	С	1
4	4	MCQ	GA	С	1
5	4	МСQ	GA	С	1
6	4	MCQ	GA	В	2
7	4	МСQ	GA	D	2
8	4	MCQ	GA	Α	2
9	4	MCQ	GA	С	2
10	4	МСQ	GA	С	2
11	4	MCQ	СН	D	1
12	4	МСQ	СН	В	1
13	4	MCQ	СН	С	1
14	4	MCQ	СН	Α	1
15	4	MCQ	СН	D	1
16	4	MCQ	СН	Α	1
17	4	MCQ	СН	Α	1
18	4	MCQ	СН	Α	1
19	4	MCQ	СН	D	1
20	4	MCQ	СН	Α	1
21	4	MCQ	СН	С	1
22	4	MCQ	СН	С	1
23	4	MCQ	СН	A	1
24	4	MCQ	СН	В	1
25	4	MCQ	СН	С	1
26	4	MCQ	СН	С	1
27	4	MCQ	СН	Α	1
28	4	NAT	СН	2.830 to 2.850	1
29	4	NAT	СН	178.7 to 180.7	1
30	4	NAT	СН	0.14 to 0.15	1
31	4	NAT	СН	53.0 to 54.0	1
32	4	NAT	СН	221.0 to 223.0	1
33	4	NAT	СН	8.0 to 8.4	1
34	4	NAT	СН	2 to 2	1
35	4	NAT	СН	24.7 to 25.1	1
36	4	MCQ	СН	A	2
37	4	MCQ	СН	A	2
38	4	MCQ	СН	A	2
39	4	MCQ	СН	В	2
40	4	MCQ	СН	A	2
41	4	MCQ	СН	A	2
42	4	MCQ	СН	B	2
43	4	MCQ	СН	C	2
44	4	NAT	СН	4.20 to 4.30	2





45	4	NAT	СН	191.9 to 192.1	2
46	4	NAT	СН	0.860 to 0.880	2
47	4	NAT	СН	0 to 0	2
48	4	NAT	СН	0 to 0	2
49	4	NAT	СН	36.3 to 38.3	2
50	4	NAT	СН	0.95 to 1.05	2
51	4	NAT	СН	87.0 to 88.0 OR 161.7 to 163.2	2
52	4	NAT	СН	3.10 to 3.17	2
53	4	NAT	СН	20 to 20	2
54	4	NAT	СН	94 to 94	2
55	4	NAT	СН	675 to 680	2
56	4	NAT	СН	0.61 to 0.65	2
57	4	NAT	СН	10.0 to 12.0	2
58	4	NAT	СН	0.70 to 0.72	2
59	4	NAT	СН	-4 to -4 OR 4 to 4	2
60	4	NAT	СН	0.54 to 0.56	2
61	4	NAT	СН	52.0 to 54.0	2
62	4	NAT	СН	3 to 3	2
63	4	NAT	СН	38.0 to 38.5	2
64	4	NAT	СН	47.0 to 49.0	2
65	4	NAT	СН	50 to 50	2