

Fundamentals_Engineering

FE Chemical

DAY	Topic/ Number of Questions	Knowledge Area	V	DAY	Topic/ Number of Questions	Knowledge Area	V
1	1. Mathematics 6-9	A. Analytic geometry, logarithms, and trigonometry		60	Rest	Rest; Review	
2		B. Calculus (e.g., single-variable, integral, differential)		61	9. Heat Transfer 8-12	E. Heat-transfer equipment, operation, and design (e.g., double pipe, shell and tube, fouling, number of transfer units, log-mean temperature difference, flow configuration)	
3		C. Differential equations (e.g., ordinary, partial, Laplace)		62	10. Mass Transfer and Separation 8-12	A. Molecular diffusion (e.g., steady and unsteady state, physical property estimation)	
4		D. Numerical methods (e.g., error propagation, Taylor's series, curve fitting, Newton-Raphson, Fourier series)		63		B. Convective mass transfer (e.g., mass-transfer coefficient, eddy diffusion)	
5		E. Algebra (e.g., fundamentals, matrix algebra, systems of equations)		64		C. Separation systems (e.g., distillation, absorption, extraction, membrane processes, adsorption)	
6	Rest	Rest; Review		65	D. Equilibrium stage methods (e.g., graphical methods, McCabe-Thiele, efficiency)		
7	1. Mathematics 6-9	F. Accuracy, precision, and significant figures		66	Rest	Rest; Review	
8	2. Probability and Statistics 4-6	A. Probability distributions (e.g., discrete, continuous, normal, binomial)		67	10. Mass Transfer and Separation 8-12	E. Continuous contact methods (e.g., number of transfer units, height equivalent to a theoretical plate, height of transfer unit, number of theoretical plates)	
9		B. Expected value (weighted average) in decision making		68	F. Humidification, drying, and evaporation		
10		C. Hypothesis testing and design of experiments (e.g., t-test, outlier testing, analysis of the variance)		69	11. Solids Handling 3-5	A. Particle properties (e.g., surface and bulk forces, particle size distribution)	
11		D. Measures of central tendencies and dispersions (e.g., mean, mode, standard deviation, confidence intervals)		70		B. Processing (e.g., crushing, grinding, crystallization)	
12	Rest	Rest; Review		71	C. Transportation and storage (e.g., belts, pneumatic, slurries, tanks, hoppers)		
13	2. Probability and Statistics 4-6	E. Regression and curve fitting		72	Rest	Rest; Review	
14		F. Statistical control (e.g., control limits)		73	12. Chemical Reaction Engineering 7-11	A. Reaction rates and order	
15	3. Engineering Sciences 4-6	A. Basic dynamics (e.g., friction, force, mass, acceleration, momentum)		74		B. Rate constant (e.g., Arrhenius function)	
16		B. Work, energy, and power (as applied to particles or rigid bodies)		75		C. Conversion, yield, and selectivity	
17		C. Electricity, current, and voltage laws (e.g., charge, energy, current, voltage, power, Kirchhoff's law, Ohm's law)		76		D. Type of reactions (e.g., series, parallel, forward, reverse, homogeneous, heterogeneous, biological)	
18	Rest	Rest; Review		77		E. Reactor types (e.g., batch, semibatch, continuous stirred tank, plug flow, gas phase, liquid phase)	
19	4. Materials Science 4-6	A. Chemical, electrical, mechanical, and physical properties (e.g., effect of temperature, pressure, stress, strain, failure)		78	Rest	Rest; Review	
20		B. Material types and compatibilities (e.g., engineered materials, ferrous and nonferrous metals)		79	12. Chemical Reaction Engineering 7-11	F. Catalysis (e.g., mechanisms, biocatalysis, physical properties)	
21		C. Corrosion mechanisms and control		80	13. Economics 4-6	A. Time value of money (e.g., present worth, annual worth, future worth, rate of return)	
22		D. Polymers, ceramics, and composites		81		B. Economic analyses (e.g., break-even, benefit-cost, optimal economic life)	
23	5. Chemistry and Biology 7-11	A. Inorganic chemistry (e.g., molarity, normality, molality, acids, bases, redox reactions, valence, solubility product, pH, pK, electrochemistry, periodic table)		82		C. Uncertainty (e.g., expected value and risk)	
24	Rest	Rest; Review		83	D. Project selection (e.g., comparison of projects with unequal lives, lease/buy/make, depreciation, discounted cash flow)		
25	5. Chemistry and Biology 7-11	B. Organic chemistry (e.g., nomenclature, structure, balanced equations, reactions, synthesis)		84	Rest	Rest; Review	
26		C. Analytical chemistry (e.g., wet chemistry and instrumental chemistry)		85	14. Process Design 7-11	A. Process flow diagrams and piping and instrumentation diagrams	
27		D. Biochemistry, microbiology, and molecular biology (e.g., organization and function of the cell; Krebs, glycolysis, Calvin cycles; enzymes and protein chemistry; genetics; protein synthesis, translation, transcription)		86		B. Equipment selection (e.g., sizing and scale-up)	
28		E. Bioprocessing (e.g., fermentation, biological treatment systems, aerobic, anaerobic process, nutrient removal)		87		C. Equipment and facilities cost estimation (e.g., cost indices, equipment costing)	
29		6. Fluid Mechanics/Dynamics 8-12	A. Fluid properties			88	D. Process design and optimization (e.g., sustainability, efficiency, green engineering, inherently safer design, evaluation of specifications, product design)
30	Rest	Rest; Review		89		E. Design standards (e.g., regulatory, ASTM, ISO, OSHA)	
31	6. Fluid Mechanics/Dynamics 8-12	B. Dimensionless numbers (e.g., Reynolds number)		90	Rest	Rest; Review	
32		C. Mechanical energy balance (e.g., pipes, valves, fittings, pressure losses across packed beds, pipe networks)		91	15. Process Control 4-6	A. Dynamics (e.g., first- and second-order processes, gains and time constants, stability, damping, and transfer functions)	
33		D. Bernoulli equation (hydrostatic pressure, velocity head)		92		B. Control strategies (e.g., feedback, feedforward, cascade, ratio, PID controller tuning, alarms, other safety equipment)	
34		E. Laminar and turbulent flow		93		C. Control loop design and hardware (e.g., matching measured and manipulated variables, sensors, control valves, conceptual process control, distributed control system [DCS] programming, programmable logic controller [PLC] programming, interlocks)	
35		F. Flow measurement (e.g., orifices, Venturi meters)		94		A. Hazardous properties of materials, including SDS (e.g., corrosivity, flammability, toxicity, reactivity, handling, storage, transportation)	
36		Rest	Rest; Review		95	B. Industrial hygiene (e.g., toxicity, noise, PPE, ergonomics)	
37	6. Fluid Mechanics/Dynamics 8-12	G. Pumps, turbines, compressors, and vacuum systems		96	Rest	Rest; Review	
38		H. Compressible flow and non-Newtonian fluids		97	C. Process safety, risk assessment, and hazard analysis (e.g., layer of protection analysis, hazard and operability [HAZOP] studies, fault and event tree analysis, dispersion modeling)		
39		A. Thermodynamic properties of pure components and mixtures (e.g., specific volume, internal energy, enthalpy, entropy, free energy, ideal gas law)		98	16. Safety, Health, and Environment 5-8	D. Overpressure and underpressure protection (e.g., relief, redundant control, inherently safe)	

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40	7. Thermodynamics 8-12	B. Properties data and phase diagrams of pure components and mixtures (e.g., steam tables, psychrometric charts, T-s, P-h, x-y, T-x-y)		99		E. Waste minimization, waste treatment, and regulation (e.g., air, water, solids, RCRA, CWA, other EPA, OSHA)	
41		C. Thermodynamic laws (e.g., first law, second law)		100		F. Reactivity hazards (e.g., inerting, runaway reactions, compatibility)	
42	Rest	Rest;Review		101	17. Ethics and Professional Practice 3-5	A. Codes of ethics (professional and technical societies)	
43		D. Thermodynamic processes (e.g., isothermal, adiabatic, isentropic, phase changes)		102	Rest	Rest;Review	
44	7. Thermodynamics 8-12	E. Cyclic processes and efficiencies (e.g., power, refrigeration, heat pump)		103		B. Agreements, contracts, and contract law (e.g., noncompete, nondisclosure, memorandum of understanding)	
45		F. Phase equilibrium (e.g., fugacity, activity coefficient, Raoult's law)		104	17. Ethics and Professional Practice 3-5	C. Public health, safety, and welfare (e.g., public protection issues, licensing, professional liability, regulatory issues)	
46		G. Chemical equilibrium		105		D. Intellectual property (e.g., copyright, trade secrets, patents, trademarks)	
47		H. Heats of reaction and mixing		106	Rest	Rest	
48	Rest	Rest;Review		107		Test;Review	
49		A. Steady-state mass balance		108		Test;Review	
50		B. Unsteady-state mass balance		109	Test;Review	Test;Review	
51	8. Material/Energy Balances 10-15	C. Steady-state energy balance		110		Test;Review	
52		D. Unsteady-state energy balance		111		Test;Review	
53		E. Recycle/bypass processes		112	Rest	Rest	
54	Rest	Rest;Review		113	Exam	Exam	
55	8. Material/Energy Balances 10-15	F. Reactive systems (e.g., combustion)					
56		A. Conductive heat transfer					
57	9. Heat Transfer 8-12	B. Convective heat transfer (natural and forced)					
58		C. Radiation heat transfer					
59		D. Heat-transfer coefficients (e.g., overall, local, fouling)					

