

Id	
Question	Which of the following is a secondary chemical fuel
A	Petrol
B	Petroleum
C	Vegetable oil
D	Natural gas
Answer	A
Marks	1
Unit	4a1

Id	
Question	The relation between G.C.V. and N.C.V. values of the same fuel shows
A	N.C.V. higher than G.C.V.
B	N.C.V. lower than G.C.V.
C	Some times G.C.V. higher
D	Some times N.C.V .higher
Answer	B
Marks	1
Unit	4a1

Id	
Question	The important characteristic for a good fuel is
A	Moderate ignition temperature and high calorific value
B	Low ignition temperature
C	High ignition temperature
D	High calorific value
Answer	A
Marks	1
Unit	4a1

Id	
Question	In order to calculate LCV of a fuel
A	Percentage of hydrogen should be known
B	Oxygen content is required
C	High calorific value of fuel is required
D	Amount of air for combustion is required.
Answer	A
Marks	1
Unit	4a1

Id	
Question	Which of the following statement is not true for GCV
A	It is Higher Calorific Value.
B	It is Theoretical Calorific Value.
C	It is Lower Calorific Value.
D	It is Gross Calorific Value
Answer	C
Marks	1
Unit	4a1

Id	
Question	Which of the following is not the unit used for Calorific Value
A	Cal/m
B	K cal/m ³
C	MJ/m ³
D	Joules/kg
Answer	A
Marks	1
Unit	4a1

Id	
Question	Calorific value of a fuel is the total quantity of _____ liberated by complete combustion of unit mass of the fuel
A	Heat
B	Colour
C	Light
D	Combustion gases
Answer	A
Marks	1
Unit	4a1

Id	
Question	Unit of calorific value is _____
A	K cal/m
B	Joules
C	B.Th.U.
D	Cal/gm
Answer	D
Marks	1
Unit	4a1

Id	
Question	Gross calorific value is the total amount of heat liberated, when unit mass/volume of the fuel is burnt completely and _____
A	Products of combustion are allowed to escape
B	Products of combustion are allowed to cool to room temperature
C	Products of combustion are filtered
D	None of these
Answer	B
Marks	1
Unit	4a1

Id	
Question	NCV = GCV - _____xHx587 k cal/kg
A	0.9
B	9.00
C	0.09
D	90.00
Answer	C
Marks	1
Unit	4a1

d	
Question	Relation of Gross calorific value & Net calorific value is given by following formula
A	$GCV = NCV - 0.09 \times H \times 587 \text{ k cal/kg}$
B	$GCV = NCV + 0.09 \times H \times 587 \text{ k cal/kg}$
C	$NCV = GCV + 0.09 \times H \times 587 \text{ k cal/kg}$
D	$NCV = GCV - 0.09 \times H \times 587 \text{ k cal/kg}$
Answer	D
Marks	1
Unit	4a1

Id	
Question	Which of the following constituents of a fuel do not contribute to its calorific value on combustion?
A	Hydrogen
B	Sulphur
C	Carbon
D	Nitrogen
Answer	D
Marks	1
Unit	4a1

Id	
Question	Gross and net calorific value of a fuel will be the same _____.
A	If its ash content is zero.
B	If its carbon content is very low
C	If its hydrogen content is zero.
D	Under no circumstances.
Answer	C
Marks	1
Unit	4a1

Id	
Question	The minimum temperature at which continuous combustion of the fuel starts is
A	Ignition temperature
B	Transition temperature
C	Boiling point
D	None of these
Answer	A
Marks	1
Unit	4a1

Id	
Question	A good quality of fuel should have low moisture content because it-----
A	Increases the weight of fuel
B	Decreases calorific value
C	Becomes tedious for storage and transportation
D	All of these
Answer	D
Marks	1
Unit	4a1

Id	
Question	The amount of heat required to raise the temperature of 1 gm of water through 1°C is
A	1 calorie
B	1 calorie/ml
C	1 joule
D	1 joule/1m ³
Answer	A
Marks	1
Unit	4a1

Id	
Question	A good fuel should have _____ calorific value.
A	High
B	Moderate
C	Low
D	Very low
Answer	A
Marks	1
Unit	4a1

Id	
Question	Latent heat of condensation of steam is,
A	587 J/gm
B	587 cal/kg
C	587 cal/gm
D	587 Kcal/gm
Answer	C
Marks	1
Unit	4a1

Id	
Question	Which of the following is not a fossil fuel?
A	Petroleum oil
B	Biodiesel
C	Natural gas
D	Coal
Answer	B
Marks	1
Unit	4a1

Id	
Question	The relation between Gross calorific value (GCV) and Net calorific value(NCV) for a hydrocarbon fuel can be explained as _____
A	GCV / NCV
B	$GCV \leq NCV$
C	$GCV = NCV$
D	$GCV > NCV$
Answer	D
Marks	1
Unit	4a1

Id	
Question	A good fuel should have _____ ash content.
A	Very high
B	High
C	Moderate
D	Low
Answer	D
Marks	1
Unit	4a1

Id	
Question	Net calorific value is the total amount of heat liberated when unit mass/volume of the fuel is burnt completely and _____.
A	There will be no products of combustion.
B	Products of combustion are allowed to escape.
C	Products of combustion are allowed to cool to room temperature.
D	None of these.
Answer	B
Marks	1
Unit	4a1

Id	
Question	NCV = GCV – _____ \times H \times 587 kcal/kg.
A	9
B	0.9
C	0.09
D	0.01
Answer	C
Marks	1
Unit	4a1

Id	
Question	If fuel contains 1 % hydrogen, the latent heat of vapour formed will be_____
A	52.83 cal/gm
B	587 cal/gm
C	6522.22 cal/gm
D	5.283 cal/gm
Answer	A
Marks	1
Unit	4a1

Id	
Question	SI unit of calorific value is _____
A	Cal/gm
B	Kcal/kg
C	J/kg
D	J/lb
Answer	C
Marks	1
Unit	4a1

Id	
Question	In the relation between N.C.V. and G.C.V. the factor $0.09H$ is ----- .
A	Mass of hydrogen formed per unit mass of fuel.
B	Mass of steam formed per unit mass of fuel.
C	Volume of steam formed
D	Mass of hydrogen formed
Answer	B
Marks	1
Unit	4a1

Id	
Question	One part by weight of hydrogen forms ----- parts by weight of steam.
A	6
B	18
C	9
D	16
Answer	C
Marks	1
Unit	4a1

Id	
Question	1Kcal/kg =----- Cal/gm
A	10
B	0.1
C	1000
D	1
Answer	D
Marks	1
Unit	4a1

Id	
Question	Bomb calorimeter is not used for finding calorific value of _____
A	Coal
B	Ethyl alcohol
C	Biodiesel
D	Charcoal
Answer	B
Marks	1
Unit	4b1

Id	
Question	Principle of Bomb calorimeter is _____.
A	Total heat liberated by complete combustion of known amount of fuel is absorbed by known mass of water in calorimeter
B	Total heat liberated by complete combustion of known amount of fuel is eliminated by known mass of water in calorimeter
C	Total heat liberated by complete combustion of known amount of fuel is absorbed by known mass of kerosene in calorimeter
D	None of the above
Answer	A
Marks	1
Unit	4a2

Id	
Question	Function of air jacket in Bomb calorimeter experiment is
A	To minimize heat loss
B	To allow heat loss by radiation
C	To help complete combustion of fuel
D	To absorb heat obtained from fuel
Answer	A
Marks	1
Unit	4a2

Id	
Question	In the calculation of G.C.V. of fuel by Bomb calorimeter cooling correction is
A	Added in the actual rise in temp.
B	Subtracted from the actual rise in temp.
C	Multiplied with actual rise in temp.
D	Divided to actual rise in temp.
Answer	A
Marks	1
Unit	4a2

Id	
Question	Bomb calorimeter is used for determination of calorific value of _____
A	Solid fuel
B	Semisolid fuel
C	Nonvolatile liquid fuel
D	All of these
Answer	D
Marks	1
Unit	4a2

Id	
Question	Bomb pot is immersed in copper calorimeter containing
A	Known mass of fuel
B	Known mass of water
C	Known mass of acid
D	All of the above
Answer	B
Marks	1
Unit	4a2

Id	
Question	Principle of Bomb calorimeter is heat given out by known mass of fuel is equal to_____
A	Heat dissipated by the known mass of water
B	Heat absorbed by the known mass of water
C	Heat absorbed by the known amount of air
D	Heat absorbed by the known mass of calorimeter
Answer	B
Marks	1
Unit	4a2

Id	
Question	Acid correction occurs due to formation of
A	CH ₃ COOH and HCOOH
B	H ₂ SO ₄ and HNO ₃
C	NaOH and H ₂ SO ₄
D	HCl and KCl
Answer	B
Marks	1
Unit	4a2

Id	
Question	What is the NCV of solid fuel containing 5% hydrogen whose GCV is 7500 cal/gm.
A	7235.85cal/gm
B	723.85 cal/gm
C	7235.85J/Kg
D	None of above
Answer	A
Marks	2
Unit	4 D

Id	
Question	Acid Correction should be subtracted during calculating GCV for Bomb Calorimeter as it involves-
A	Exothermic Reaction
B	Displacement Reaction
C	Neutralization Reaction
D	Endothermic Reaction
Answer	A
Marks	1
Unit	4a2

Id	
Question	The Calorific Value of a Solid fuel can be determined using the apparatus called-
A	Junker's Calorimeter
B	Colorimeter
C	Bomb Calorimeter
D	Boy's Calorimeter
Answer	C
Marks	1
Unit	4a2

Id	
Question	For estimation of sulphur the coal sample is burnt -----
A	In Bomb calorimeter
B	By Eschka method
C	Either of these
D	None of theses
Answer	C
Marks	1
Unit	4a2

Id	
Question	Water equivalent of a bomb calorimeter indicates
A	Weight of water in calorimeter
B	Weight of water which absorbs same amount of heat as absorbed by calorimeter apparatus
C	Amount of water in bomb pot
D	None of above
Answer	B
Marks	1
Unit	4a2

Id	
Question	In Bomb calorimeter experiment the bomb pot is made up of _____
A	Plastic
B	Copper
C	Stainless steel
D	Nickel
Answer	C
Marks	1
Unit	4a2

Id	
Question	The function of stirrer in the Bomb calorimeter is_____
A	To stir the fuel uniformly
B	To dissipate the heat absorbed by the water uniformly
C	To make homogeneous solution of water and fuel
D	None of these
Answer	B
Marks	1
Unit	4a2

Id	
Question	In Bomb calorimeter experiment the connection between the electrodes and the fuel is established by_____
A	Magnesium fuse wire
B	Oxygen valve
C	Stirrer
D	water
Answer	A
Marks	1
Unit	4a2

Id	
Question	The correct formula to find Gross calorific value(GCV) of the solid fuel is _____.If W =weight of water, ω = water equivalent,($t_2 - t_1$) = rise in temperature and x = weight of fuel.
A	
B	
C	
D	
Answer	
Marks	
Unit	

Id	
Question	In Bomb calorimeter experiment the electrodes are made up of _____
A	Zinc
B	Iron
C	Copper
D	Stainless steel
Answer	D
Marks	1
Unit	4a2

Id	
Question	The correct formula to find Gross calorific value(GCV) of the solid fuel is _____.If W =weight of water, ω = water equivalent,($t_2 - t_1$) = rise in temperature and x = weight of fuel, t_a = acid correction, t_f = fuse wire correction, t_c = cooling correction
A	
B	
C	
D	
Answer	
Marks	
Unit	

Id	
Question	The Acid correction should be _____from total heat released during the calculation of GCV by Bomb calorimeter
A	Added
B	Subtracted
C	Multiplied
D	Divided
Answer	B
Marks	1
Unit	4a2

Id	
Question	The correct formula to find Gross calorific value(GCV) of the solid fuel is _____.If W =weight of water, ω = water equivalent,($t_2 - t_1$) = rise in temperature and x = weight of fuel, t_a = acid correction.
A	
B	
C	
D	
Answer	
Marks	
Unit	

Id	
Question	The fuse wire correction should be _____from the total heat released during the calculation of GCV by Bomb calorimeter
A	Added
B	Subtracted
C	Multiplied
D	Divided
Answer	B
Marks	1
Unit	4a2

Id	
Question	Acid correction in the GCV of solid fuel by Bomb calorimeter involves
A	formation of sulphuric and nitric acid by exothermic reaction
B	formation of sulphuric and nitric acid by endothermic reaction
C	formation of sulphuric and nitric acid by displacement reaction
D	formation of sulphuric and nitric acid by redox reaction
Answer	A
Marks	1
Unit	4a2

Id	
Question	The cooling correction should be _____ during the calculation of GCV by Bomb calorimeter
A	Subtracted from the GCV
B	Added to the GCV
C	Subtracted from the rise in temperature
D	Added to the rise in temperature
Answer	D
Marks	1
Unit	4a2

Id	
Question	Beckmann's thermometer is immersed in _____
A	Water jacket
B	Water in the calorimeter
C	Air jacket
D	Stainless steel bomb pot
Answer	B
Marks	1
Unit	4a2

Id	
Question	Cooling correction is calculated as
A	Time taken for the water in calorimeter to cool from the maximum temperature to room temperature
B	Rate of cooling
C	Product of A and B
D	Addition of A and B
Answer	C
Marks	1
Unit	4a2

Id	
Question	<p>Arrange the following in proper order -----</p> <p>K]Electrodes are connected to battery</p> <p>L] Note down maximum rise in temperature of water.</p> <p>N] Fuse wire is ignited which in turn ignites fuel.</p>
A	KNL
B	NLK
C	KLN
D	KNL
Answer	D
Marks	1
Unit	4a2

Id	
Question	Which calorimeter can be used to get calorific value of coke?
A	Bomb calorimeter
B	Engler calorimeter
C	Boys calorimeter
D	Redwood calorimeter
Answer	A
Marks	1
Unit	4a2

Id	
Question	Boy's calorimeter gives the calorific value of_____.
A	Non volatile Liquid Fuel
B	Gaseous fuel
C	Both a and b
D	None of the above
Answer	B
Marks	1
Unit	4a3

Id	
Question	In Boy's gas calorimeter burner is surrounded by chimney called as _____
A	Combustion chamber
B	Upper chamber
C	Burning chamber
D	None of the above
Answer	A
Marks	1
Unit	4a3

Id	
Question	In Boy's gas Calorimeter spiral tube enclosed in a fully insulated jacket is made up of
A	Brass
B	Zn
C	Cu
D	Alloy
Answer	C
Marks	1
Unit	4a3

Id	
Question	Which term is not required to determine HCV using Boy,s calorimeter.
A	Quantity of water
B	Initial temperature
C	Water equivalent
D	Final temperature
Answer	C
Marks	1
Unit	4a3

Id	
Question	In Boy,s gas calorimeter heat obtained by combustion of gas after steady state is
A	Absorbed completely by circulating water
B	Absorbed by calorimeter set and circulating water
C	Absorbed completely by calorimeter
D	Not absorbed by circulating water and calorimeter
Answer	A
Marks	1
Unit	4a3

Id	
Question	Boys gas calorimeter is suitable for determination of calorific value of
A	Volatile liquid fuel
B	Gaseous fuel
C	Both A and B
D	None of these
Answer	C
Marks	1
Unit	4a3

Id	
Question	In Boys gas calorimeter, the combustion chamber is surrounded by the tubing on the inner and outer surface which is made up of
A	Stainless steel
B	Copper
C	Nickel
D	Iron
Answer	B
Marks	1
Unit	4a3

Id	
Question	Water equivalent is not considered for calculation of calorific value by Boys gas calorimeter because
A	It is not convenient to calculate water equivalent in Boys gas calorimeter
B	Water equivalent is considered in the form of the mass of steam condensed
C	Heat given out by combustion of fuel is taken up by circulating water and no heat is retained by the apparatus
D	Instead of crucible, fuel is burnt by using a burner
Answer	C
Marks	1
Unit	4a3

Id	
Question	Proximate analysis involves determination of _____.
A	% Ash ,% VM, % moisture, %FC of coal
B	%C, %H, % O of coal
C	%S of coal
D	VM, % moisture,%FC of coal
Answer	A
Marks	1
Unit	4b1

Id	
Question	For determination of % VM coal sample is kept in muffle furnace at _____ for.....
A	900 ^o C, 5 min
B	725 ^o C, 5 min
C	800 ^o C, 8 min
D	925 ^o C, 7 min
Answer	D
Marks	1
Unit	4b1

Id	
Question	Which of the following has property of absorbing moisture
A	KOH solution
B	BaCl ₂
C	Anhydrous CaCl ₂
D	NaOH solution
Answer	C
Marks	1
Unit	4b1

Id	
Question	A higher volatile matter in coal causes
A	Pollution in air
B	Decrease in calorific value of coal
C	Elongates flame and decreases flame temperature
D	All of these
Answer	D
Marks	1
Unit	4b1

Id	
Question	Which of the following has property of absorbing CO ₂
A	Anhydrous CaCl ₂
B	Magnesium perchlorate
C	Conc. H ₂ SO ₄
D	KOH solution
Answer	D
Marks	1
Unit	4b1

Id	
Question	During estimation of sulphur from coal, sulphur finally gets converted into
A	CaSO ₄
B	BaCl ₂
C	CaCl ₂
D	BaSO ₄
Answer	D
Marks	1
Unit	4b1

Id	
Question	During estimation of %N, the gas liberated is
A	N ₂
B	NH ₃
C	CO ₂
D	CO
Answer	B
Marks	1
Unit	4b1

Id	
Question	For % moisture determination in proximate analysis of coal, coal has to be heated to---- for 1 hour
A	700± 50°C
B	925± 20°C
C	105-110°C
D	50± 10°C
Answer	C
Marks	1
Unit	4b1

Id	
Question	For % ash determination in proximate analysis of coal, coal has to be heated to-----for 1/2 hour
A	700 \pm 50°C
B	925 \pm 20°C
C	105-110°C
D	50 \pm 10°C
Answer	A
Marks	1
Unit	4b1

Id	
Question	A good quality of coal should have -----% volatile matter
A	High
B	Moderate
C	Low
D	Very high
Answer	C
Marks	1
Unit	4b1

Id	
Question	A good quality coal should have -----% fixed carbon
A	High
B	Moderate
C	Low
D	Very low
Answer	A
Marks	1
Unit	4b1

Id	
Question	Combustion method is used for determination of -----ultimate analysis of coal
A	%H
B	%N
C	% moisture
D	%O
Answer	A
Marks	1
Unit	4b1

Id	
Question	Kjeldahl's method is used for determination of -----in ultimate analysis
A	%H
B	%N
C	%S
D	%O
Answer	B
Marks	1
Unit	4b1

Id	
Question	Eschka method is used for determination of -----in ultimate analysis of coal
A	%H
B	%N
C	%S
D	%O
Answer	C
Marks	1
Unit	4b1

Id	
Question	In Kjeldahl's method, volume of acid consumed by ammonia is determined from
A	Blank titration reading/Back titration reading
B	Blank titration reading+Back titration reading
C	Blank titration reading-Back titration reading
D	Back titration reading-Blank titration reading
Answer	C
Marks	1
Unit	4b1

Id	
Question	Volatile matter is the matter produced from fuel due to,
A	Incomplete oxidation of fuel
B	Thermal decomposition of fuel
C	Products formed due to hydrolysis of fuel
D	All of these
Answer	B
Marks	1
Unit	4b1

Id	
Question	Which of the following statements is true,
A	Coke burns with long flame
B	Sulphur % in coke is higher than coal
C	Calorific value of coke is higher than coal
D	Coke burns with smoky flame
Answer	C
Marks	1
Unit	4b1

Id	
Question	In proximate analysis of coal, the function of desiccators is
A	It helps to evaporate volatile matter
B	It prevents the loss of moisture from the coal
C	It prevents the adsorption of external moisture on coal
D	It prevents the volatile matter to escape
Answer	C
Marks	1
Unit	4b1

Id	
Question	In proximate analysis of air dried coal, the % volatile matter determination deals with_____
A	Amount of volatile matter present in the coal
B	Amount of volatile matter added to the coal
C	Amount of volatile matter getting formed during thermal degradation
D	None of these
Answer	C
Marks	1
Unit	4b1

Id	
Question	In ultimate analysis, the percentage carbon is determined by burning the sample in the presence of oxygen and absorbing the products of combustion in U tube containing_____
A	Calcium chloride
B	Potassium hydroxide
C	Magnesium per chlorate
D	Standard acid
Answer	B
Marks	1
Unit	4b1

Id	
Question	In ultimate analysis, the percentage hydrogen is determined by burning the sample in the presence of oxygen and absorbing the products of combustion in U tube containing_____
A	Anhydrous calcium chloride
B	Potassium hydroxide solution
C	Lime soda
D	Standard acid
Answer	A
Marks	1
Unit	4b1

Id	
Question	Following is not true for the significance of ultimate analysis of coal
A	Higher the % C, better the quality of coal.
B	Lower the % N, better the quality of coal
C	Higher the % oxygen, better the quality of coal
D	Lower the %ash, better the quality of coal
Answer	C
Marks	1
Unit	4b1

Sr.No.	Question	Option	Mks	Gr
1.	The concept of Green Chemistry was developed by a) Bragg b) Paul Anestas c) Mendeleef d) Dalton	b	1	C
2.	Green Chemistry is also called as a) Benign chemistry b) Environmental chemistry c) Ecology d) None of the above	a	1	C
3.	Greener pathway of synthesis a) Utilizes renewable inputs b) Eliminates hazardous by products c) Eliminates disposal costs d) All of the above	d	1	C
4.	Benign substances are substances that do not have a) Environmental risk b) Economical risk c) Chemical risk d) Social risk	a	1	C
5.	To use effective mass yield metric it is necessary to have a) Human toxicity information for all chemicals b) Eco toxicity information for all chemicals c) Both a) and b) d) None of above	c	1	C
6.	Carbon efficiency calculations include a) Yield b) Stoichiometry of reactants c) Stoichiometry of products d) All of above	d	1	C
7.	Carbon efficiency shows a) Clean-ness of a reaction b) Clean-ness of the process c) Clean-ness of environment d) All of the above	a	1	C

8.	Atom economy calculations ignores a) Reaction yield b) Molar excesses of reactants c) Molar excesses of reagents d) All of the above	d	1	C
9.	Atom economy takes in to account a) All of the reactants b) All of the intermediates c) All of the products d) None of the above	a	1	C

10.	Environmental factor a) Ignores recyclable factors b) Considers recyclable factors c) Considers energy factors d) Considers recovery factors	a	1	C
11.	Environmental factor is ratio of a) The e mass of waste per unit product b) The mass of product per unit waste c) The mass of waste per unit of reagent d) The mass of reagent per unit of product	d	1	C
12.	Mass intensity is expressed on a) Weight basis b) Volume basis c) Percentage basis d) Percentile basis	a	1	C
13.	Mass intensity takes into account a) The yield b) The stiochiometry of solvent c) The stiochiometry of reagent d) All of the above	a	1	C
14.	Adipic acid synthesis by using green and clean technology uses a) Benzene b) Chlorobenzene c) Glucose d) None of these	c	1	C
15.	Among the following, which is carcinogenic a) Carbon b) Benzene c) Ammonia d) Glucose	b	1	C

16.	Green route synthesis of adipic acid involves a) Use of benzene b) Use of glucose c) Generation of nitrous oxide d) Use of high pressure equipment	b	1	C
17.	Commercial synthesis of polycarbonates involves use of a) Phosgene b) Methylene chloride c) Large quantity of water d) All of the above	a	1	C
18.	Green synthesis of polycarbonates involves use of a) Phosgene b) Methylene chloride c) Large quantity of water d) None of the above	d	1	C
19.	Green synthesis of polycarbonates involves use of a) Ethylene oxide b) Carbon dioxide c) Bisphenol-A d) All of the above	d	1	C

20.	Pleger recognized that yield of indigo improves dramatically due to use of a) NaOH b) KOH c) NaNH ₂ d) Oxygen	c	1	C
21.	Tryptophan has a) Soil origin b) Animal origin c) Plant origin d) Synthetic origin	c	1	C
22.	Electrodialysis are carried out under the influence of an..... a) Applied current b) Applied temperature c) Applied pressure d) Applied potential	c	1	C
23.	Multiple Electrodialysis cells consists ofexchange membranes & electrode. a) Cation b) Anion c) Both d) Neutra	c	1	C

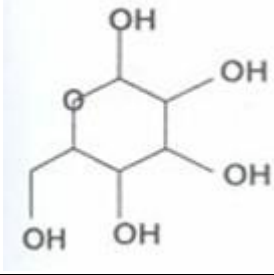
24.	The flow of water (or other solvent) through a semipermeable membrane due to concentration difference is called a) Reverse osmosis b) Osmosis c) Electrodialysis d) Filtration	b	1	C
25.	Desalination can be performed by two processes namely & thermal process. a) Membrane b) Filtration c) Coulometry d) All of the above	a	1	C
26.	Atom economy may be given as a) $(\text{MW of desired product} / \text{MW of all reactants}) \times 100$ b) $(\text{amount of reactant reacted} / \text{amount of reactants taken}) \times 100$ c) $(\text{amount of desired product} / \text{MW of all reactants}) \times 100$ d) $(\text{amount of product formed} / \text{MW of all reactants}) \times 100$	a	1	C

27.	Reaction selectivity can be defined as a) $(\text{amount of desired product formed} / \text{amount of product expected on the basis of amount of reactant consumed}) \times 100$ b) $(\text{amount of desired product} / \text{MW of all reactants}) \times 100$ c) $(\text{MW of by product} / \text{MW of all reactants}) \times 100$ d) $(\text{MW of desired product} / \text{MW of all reactants}) \times 100$	a	1	C
28.	% conversion is given as a) $(\text{amount of reactant reacted} / \text{amount of all reactants taken}) \times 100$ b) $(\text{amount of desired product} / \text{amount of all reactants}) \times 100$ c) $(\text{MW of by product} / \text{MW of all reactants}) \times 100$ d) $(\text{MW of desired product} / \text{MW of all reactants}) \times 100$	a	1	C
29.	Reaction yield is given as a) $(\text{amount of reactant reacted} / \text{amount of all reactants taken}) \times 100$ b) $(\text{amount of desired product} / \text{amount of all reactants}) \times 100$ c) $(\text{amount of product formed} / \text{expected amount of product}) \times 100$ d) $(\text{MW of desired product} / \text{MW of all reactants}) \times 100$	c	1	C

30.	<p>% yield is given as</p> <p>a) (amount of reactant reacted / amount of all reactants taken)$\times 100$</p> <p>b) (amount of desired product / amount of all reactants)$\times 100$</p> <p>c) (amount of product formed / expected amount of product)$\times 100$</p> <p>d) (MW of desired product / MW of all reactants)$\times 100$</p>	c	1	C
31.	<p>The max atom economy in a reaction can be</p> <p>a) 10</p> <p>b) 100</p> <p>c) 20</p> <p>d) 50</p>	b	1	C
32.	<p>Which of the reactions have atom economy 100</p> <p>a) Addition reactions</p> <p>b) Substitution reactions</p> <p>c) Dehydration</p> <p>d) All of the above</p>	a	1	C

33.	<p>Environment load factor is denoted as</p> <p>a) RO</p> <p>b) E</p> <p>c) P</p> <p>d) M</p>	b	1	C
34.	<p>The E factor in a reaction should be</p> <p>a) Maximum</p> <p>b) Minimum</p> <p>c) Average</p> <p>d) None of above</p>	b	1	C
35.	<p>The environmental load factor can be defined as</p> <p>a) (Amount of product formed /expected amount of by product) $\times 100$</p> <p>b) Total mass of effluent generated/ mass of desired product c) % selectivity</p> <p>d) % conversion</p>	b	1	C
36.	<p>Principle of green chemistry is</p> <p>a) Design for energy efficiency</p> <p>b) New analytical method</p> <p>c) Reducing toxicity of products</p> <p>d) All of the above</p>	d	1	C

37.	Green chemistry suggests which material as packaging material a) Thermocole b) Polyethylene c) Biodegradable polymer d) All of above	c	1	C
38.	Green chemistry reduces a) Cost b) Risk c) Waste d) All of the above	d	1	C
39.	Green chemistry recommends a) To develop process using renewable feedstock b) Low pressure reactions c) Reliable methods to monitor processes d) All of the above	d	1	C

40.	The structure given is of 	a	1 1	C C
	a) Glucose b) Sucrose c) Fructose d) None of above			
41.	The structure $\text{HOOC}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{COOH}$ is of a) Cinnamic acid b) Acetic acid c) Adipic acid d) Phosphoric acid	b	1	C
42.	Some of the basic principles of green chemistry are a) Use of non renewable feed stocks b) Increase derivatives c) Hazardous chemical synthesis d) None of the above	d	1	C

43.	Green solvents are called a) Ionic liquids b) Non-Ionic liquids c) Inorganic liquids d) None of the above	a	1	C
44.	Biocatalysis mainly includes a) Enzyme catalysis b) hormonal catalysis c) Antibody catalysis d) All of the above	d	1	C
45.	Green chemistry eliminates wastes a) At the end of the process b) At source c) Somewhere in middle of the process d) Nothing to do with waste remediation	b	1	C
46.	“ Ideal synthesis “ should be a) Atom efficient b) Safe, one step c) Involving no wasted reagents, environmentally acceptable d) All the above are correct	d	1	C
47.	Some of the basic principles of green chemistry are a) Atom economy b) Reduce Derivatives c) Design for Degradation d) All of the above	d	1	C
48.	Goals of green chemistry includes a) To develop process based on renewable raw materials	d	1	C

	b) To reduce the requirements for hazardous solvents c) To improve energy efficiency d) All of the above			
49.	Atom economy indicates a) Quality of product b) Rate of reaction c) Low cost reaction d) Intrinsic efficiency of the desired transformation	d	1	C
50.	Important goal of synthetic design is a) Reaction efficiency and product selectivity b) moderate Quality of product c) high Quantity of reactants d) None of the above	a	1	C

51.	In the synthesis of Indigo by Green pathway contains a) Enzymatic transformation b) Catalytic transformation c) Cyclic transformation d) Synthetic transformation	a	1	C
52.	In the synthesis of polycarbonate the 1st step is carried out in a) Solid state b) Liquid state c) Gaseous state d) Molten state	d	1	C
53.	Solvent used in synthesis of polycarbonate in Phosgene process a) Water b) Alcohol c) Methylene Chloride d) Benzene	c	1	C
54.	Starting material used in synthesis of Polycarbonate without Phosgene is a) bi- phenol –bi-carbonate b) Di-phenyl carbonate c) Dis-phenyl chloride d) Methylene Chloride	b	1	C
55.	Formula of Phosgene is – a) CaCl ₂ b) COBr ₂ c) CONH ₂ d) COCl ₂	d	1	C
56.	Structure of adipic acid is ----- a) HOOC-(CH ₂) _n -COOH b) HOOC-(CH ₂) ₃ -COOH c)HOOC-(CH ₂) ₄ -COOH d) HOOC-(CH ₂) ₅ -COOH	c	1	C
57.	Which of the following is green fuel? a)Petrol b) power alcohol c) diesel d)bio-diesel	d	1	C
58.	Green chemistry provides best opportunity to carry out work in – a) Qualitative and quantitative analysis b) Economical and environmentally beneficial way c) Both a) and b) d) None of the above	c	1	C
59.	Good Atom economy means - a) Lesser problems of waste treatment b) Better Quality of product c) Less Quantity of reactants d) Process based on non renewable resources	a	1	C
60.	Concept of green chemistry was coined by - a) Steren b) Paul Anestas c) Komiya d) Carl Sagan	b	1	C
61.	Number of principles proposed by Paul Anastis in green chemistry concept are a) 4 b) 8 c)12 d) 16	c	1	C
62.	Safer solvents for green chemistry are a) regenerative b) non inflammable c) non carcinogenic d) all of these	d	1	C

63.	Prevention of waste by product can be achieved by a) reaction with 100% atom economy b) 100% conversion of reactants c) Catalysis d) Energy efficient designs	a	1	C
64.	Green chemistry is a) chemistry of green matter in nature b) details of chemical reaction c) chemistry for safety & well being of mankind	c	1	C

	d) mechanism & kinetic study of reactions			
65.	Bhopal gas tragedy was caused due to a) Phosgene b) Chloroform c) Methyl isocyanate d) Methyl thio cyanate	c	1	C
66.	The green path of making poly carbonate uses starting material as Bis – Phenol A & a) Aniline b) CO ₂ c) Maleic anhydride d) diphenyl carbonate	d	1	C

Question	Which of the following can be used as a monomer
A	Benzoic acid
B	Acetic acid
C	Adipic acid
D	Ethanoic acid
Answer	C
Marks	1
Unit	3a1

Id	
Question	Which of the following can be used as a monomer in chain polymerization
A	Vinyl chloride
B	Adipic acid
C	Bisphenol -A
D	Ethyl chloride
Answer	A
Marks	1
Unit	3a1

Id	
Question	Which of the following can be used as an initiator for free radical polymerization
A	H ₂ O
B	H ₂ O ₂
C	H ⁺
D	OH ⁻
Answer	B
Marks	1
Unit	3a1

Id	
Question	Free radical polymerization is a
A	Oxidation reaction
B	Reduction reaction
C	Reversible reaction
D	Chain reaction
Answer	D
Marks	1
Unit	3a1

Id	
Question	Free radical polymerization reaction is
A	endothermic
B	exothermic
C	First exothermic then endothermic
D	None of the above
Answer	B
Marks	1
Unit	3a1

Id	
Question	Monomers used in chain growth polymerization are
A	Having one functional group
B	Having two functional groups
C	Saturated
D	Unsaturated
Answer	D
Marks	1
Unit	3a1

Id	
Question	Monomers used in step growth polymerization are
A	Having one functional group
B	Having two functional groups
C	saturated
D	unsaturated
Answer	B
Marks	1
Unit	3a1

Id	
Question	Ethylene can be polymerized by which mechanism?
A	Step growth polymerization
B	Chain polymerization
C	Condensation polymerization
D	None of the above
Answer	B
Marks	1
Unit	3a1

Id	
Question	Ethylene glycol can be polymerized by which mechanism?
A	Step growth polymerization
B	Chain polymerization
C	addition polymerization
D	None of the above
Answer	A
Marks	1
Unit	3a1

Id	
Question	Styrene can be polymerized by which mechanism?
A	Step growth polymerization
B	Chain polymerization
C	Condensation polymerization
D	None of the above
Answer	B
Marks	1
Unit	3a1

Id	
Question	Adipic acid can be polymerized by which mechanism?
A	Step growth polymerization
B	Chain polymerization
C	Addition polymerization
D	None of the above
Answer	A
Marks	1
Unit	3a1

Id	
Question	In chain polymerization the molecular formula of the repeat unit
A	Contains few extra atoms when compared to monomer
B	Lacks few atoms when compared to monomer
C	Is same as that of monomer
D	Is double that of monomer
Answer	C
Marks	1
Unit	3a1

Id	
Question	In step growth polymerization the molecular formula of the repeat unit
A	Contains few extra atoms when compared to monomer
B	Lacks few atoms when compared to monomer
C	Is same as that of monomer
D	Is double that of monomer
Answer	B
Marks	1
Unit	3a1

Id	
Question	Which of the following can be used as an initiator for free radical polymerization
A	Benzoyl peroxide
B	Benzoic acid
C	Benzoyl chloride
D	Benzyl alcohol
Answer	A
Marks	1
Unit	3a1

Id	
Question	Which of the following is trifunctional monomer
A	Ethylene glycol
B	Phenol
C	Vinyl chloride
D	formaldehyde
Answer	B
Marks	1
Unit	3a1

Id	
Question	Which of the following is trifunctional monomer
A	Ethylene glycol
B	Glycerol
C	Vinyl chloride
D	Acrylonitrile
Answer	B
Marks	1
Unit	3a1

Id	
Question	Which of the following can be used as an initiator for chain polymerization
A	Potassium sulphate
B	Potassium dichromate
C	Potassium persulphate
D	Potassium chloride
Answer	C
Marks	1
Unit	3a1

Id	
Question	Chain polymerization reaction is generally
A	Endothermic
B	Depends on the compound used
C	Exothermic
D	Cannot be predicted
Answer	C
Marks	1
Unit	3a1

Id	
Question	Which of the following is not a monomer?
A	$\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$
B	$\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$
C	$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$
D	$\text{CH}_3-\text{CH}=\text{CH}_2$
Answer	C
Marks	1
Unit	3a1

Id	
Question	Which of the following statement is Not True for addition polymerization?
A	Requires initiator to activate the monomer to start the reaction.
B	It is known as chain growth polymerization
C	Product obtained is an exact multiple of original monomer.
D	During propagation step small molecules are eliminated.
Answer	D
Marks	1
Unit	3a1

Id	
Question	Polymer synthesized using free radical reaction mechanism is -----
A	Epoxy resin
B	Nylon 6,6
C	LDPE
D	None of above
Answer	C
Marks	1
Unit	3a1

Id	
Question	Functionality of monomer means total number of -----
A	Functional groups
B	Double bonds
C	Reactive sites
D	Double & triple bonds
Answer	C
Marks	1
Unit	3a1

Id	
Question	Functionality of styrene is -----
A	tri-functional
B	bi-functional
C	tetra functional
D	uni-functional
Answer	B
Marks	1
Unit	3a1

Id	
Question	Acetyl peroxide on dissociation forms -----
A	Acetic acid
B	Acetyl radical
C	Acetyl oxide
D	Acetic acid & water
Answer	B
Marks	1
Unit	3a1

Id	
Question	Which of the following is a monomer?
A	$\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$
B	$\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$
C	$\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$
D	All of these
Answer	D
Marks	1
Unit	3a1

Id	
Question	Which of the following monomer can take part in addition polymerization?
A	$\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$
B	$\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$
C	$\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$
D	$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{NH}_2$
Answer	A
Marks	1
Unit	3a1

Id	
Question	Which of the following monomer cannot take part in addition polymerization?
A	$\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$
B	$\text{CH}_2=\text{CH}-\text{Cl}$
C	$\text{OH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{OH}$
D	$\text{CN}-\text{CH}=\text{CH}_2$
Answer	C
Marks	1
Unit	3a1

Id	
Question	Which of the following statement is Not True for addition polymerization?
A	Requires initiator to activate the monomer to start the eaction
B	It is known as chain growth polymerization.
C	Product obtained is an exact multiple of original monomer.
D	During propagation step small molecules are eliminated.
Answer	D
Marks	1
Unit	3a1

Id	
Question	Which of the following statement is True for condensation polymerization?
A	Monomers should have at least one unsaturation present.
B	It is known as step growth polymerization.
C	Product obtained is an exact multiple of original monomer.
D	It is known as chain growth polymerization.
Answer	B
Marks	1
Unit	3a1

Id	
Question	Initiator used in free radical reaction mechanism, on dissociation form -----
A	Free radicals
B	Ions
C	Particles
D	None of these
Answer	A
Marks	1
Unit	3a1

Id	
Question	Acetyl peroxide on dissociation forms -----
A	Acetic acid
B	Acetyl radical
C	Acetyl oxide
D	Acetic acid & water
Answer	B
Marks	1
Unit	3a1

Id	
Question	Initiator used in addition polymerization are -----
A	Acetyl peroxide
B	Benzoyl peroxide
C	Hydrogen peroxide
D	All of the above
Answer	D
Marks	1
Unit	3a1

Id	
Question	Chain polymerization reaction mechanism consist of following steps in order-----
A	Propagation □ Initiation □ Termination
B	Dissociation □ propagation □ Termination
C	Initiation □ propagation □ Termination
D	Activation □ propagation □ Termination
Answer	C
Marks	1
Unit	3a1

Question	Molecular weight of a polymer sample is expressed as an average because
A	All chains have same size
B	It is difficult to measure molecular weight of polymers
C	All chains are of average size
D	Many chains having different molecular weights are present
Answer	D
Marks	1
Unit	3a2

Id	
Question	Above glass transition temperature rubber becomes
A	Brittle
B	Soft
C	Glassy
D	Hard
Answer	B
Marks	1
Unit	3a2

Id	
Question	Below glass transition temperature rubber becomes
A	Flexible
B	Soft
C	Gummy
D	Brittle
Answer	D
Marks	1
Unit	3a2

Id	
Question	Glass transition temperature is the temperature -----
A	At which polymer is converted into glassy state.
B	Below which polymer is soft & flexible and above which it is hard & rigid
C	Below which polymer is hard & rigid and above which it is soft & flexible.
D	At which polymer is converted into visco-fluid state.
Answer	C
Marks	1

Id	
Question	Plasticizers are compounds used to
A	Decrease Tg of plastic
B	Increase Tg of plastic
C	Increase Tm of plastic
D	None of the above
Answer	A
Marks	1
Unit	3a3

Id	
Question	Plasticizers are compounds used to
A	Increase intermolecular attractions between chains
B	Decrease intermolecular attractions between chains
C	Decrease cost of plastics
D	Decrease volume of plastic
Answer	B
Marks	1
Unit	3a3

Id	
Question	Plasticizers are compounds used to
A	Increase flexibility of plastic
B	Decrease flexibility of plastic
C	Decrease cost of plastics
D	Decrease volume of plastic
Answer	A
Marks	1
Unit	3a3

Id	
Question	A filler is used during compounding to
A	Reduce cost of plastic
B	Reduce hardness of plastic
C	Increase flexibility of plastic
D	Both A and C
Answer	A
Marks	1
Unit	3a3

Id	
Question	Which of the following is used as a filler
A	Sawdust
B	Glass fibre
C	CaCO ₃
D	All of above
Answer	D
Marks	1
Unit	3a3

Id	
Question	Which of the following statement is not true for thermoplastic polymer?
A	These polymers are soluble in organic solvents.
B	These polymers can be moulded & remoulded several times
C	These polymers are soft, weak & less brittle
D	These polymers cannot be reclaimed from waste.
Answer	D
Marks	1
Unit	3a3

Id	
Question	Which of the following statement is only true for thermosetting polymer?
A	These polymers can be moulded & remoulded several times
B	These polymers are soft, weak & less brittle.
C	These polymers cannot be reclaimed from waste.
D	These polymers are soluble in organic solvents.
Answer	C
Marks	1
Unit	3a3

Id	
Question	From the following polymers which is not thermoplastic polymer?
A	Polyvinyl chloride
B	Phenol formaldehyde resin
C	polystyrene
D	polyethylene
Answer	B
Marks	1
Unit	3a3

Id	
Question	Which statement is not correct?
A	Thermosetting polymers are generally formed by condensation reaction
B	Thermoplastic polymers can be dissolved in organic solvent
C	Thermoplastic polymers cannot be reclaimed from waste
D	Thermoplastic consists of 3 dimensional cross linked network structure
Answer	D
Marks	1
Unit	3a3

Id	
Question	Which of the following statement is only true for thermosetting polymer?
A	These polymers can be moulded & remoulded several times
B	These polymers are soft, weak & less brittle.
C	These polymers cannot be reclaimed from waste.
D	These polymers are soluble in organic solvents.
Answer	C
Marks	1
Unit	3a3

Id	
Question	Which of the following statement is not true for thermosoftening polymer?
A	These polymers are soluble in organic solvents.
B	These polymers can be moulded & remoulded several times
C	These polymers are soft, weak & less brittle.
D	These polymers cannot be reclaimed from waste.
Answer	D
Marks	1
Unit	3a3

Id	
Question	In compounding of plastics, plasticizers added are -----
A	Tributyl phosphate
B	Vegetable oils
C	Tricresyl phosphate
D	All of these
Answer	D
Marks	1
Unit	3a3

Id	
Question	Stabilizers are added to plastics to -----
A	Reduce thermal stability
B	Improve strength
C	Reduce weight
D	Improve thermal stability
Answer	D
Marks	1
Unit	3a3

Id	
Question	Fillers are added to plastic to impart
A	Impart better hardness & tensile strength
B	Impart better opacity & workability
C	Reduce cost
D	All of these
Answer	D
Marks	1
Unit	3a3

Id	
Question	A thermoplastic is generally formed by reaction,
A	Nitration
B	Chlorination
C	Condensation
D	Addition
Answer	D
Marks	1
Unit	3a3

Id	
Question	Compounding of plastic is the process of -----
A	Formation of complex with polymer
B	Mixing various ingredients into polymer matrix to develop required properties
C	Moulding or remoulding of plastic
D	Fabrication of plastic
Answer	B
Marks	1
Unit	3a3

Id	
Question	Advantage of bulk polymerization is
A	Good control over reaction temperature
B	Pure polymer is obtained
C	Easy to stir the reaction mixture
D	Beads of polymer are obtained
Answer	B
Marks	1
Unit	3b1

Id	
Question	Disadvantage of bulk polymerization technique is
A	Polymer is obtained in the form of beads
B	Viscosity increase causes stirring problems
C	Removal of solvent is difficult
D	Purity of polymer is low
Answer	B
Marks	1
Unit	3b1

Id	
Question	Advantage of solution polymerization technique is
A	Solvent helps in heat dissipation
B	Viscosity increase causes stirring problems
C	Output of polymer is high
D	Purity of polymer is high
Answer	A
Marks	1
Unit	3b1

Id	
Question	Advantage of suspension polymerization technique is
A	Water helps in heat dissipation
B	Viscosity increase causes stirring problems
C	Output of polymer is high
D	Purity of polymer is high
Answer	A
Marks	1
Unit	3b1

Id	
Question	Disadvantage of solution polymerization technique is
A	Cost of solvent increases cost of polymer
B	Purity of polymer is low
C	Output of polymer is less
D	All of above
Answer	D
Marks	1
Unit	3b1

Id	
Question	In emulsion polymerization technique polymer is obtained in the form of
A	Beads
B	Latex
C	Solution
D	Pellets
Answer	B
Marks	1
Unit	3b1

Id	
Question	Emulsion polymerization technique is used in the preparation of
A	Epoxy resin
B	Polyethylene
C	Synthetic rubber
D	Nylon
Answer	C
Marks	1
Unit	3b1

Id	
Question	Initiator used in emulsion polymerization is
A	Benzoyl peroxide
B	AIBN
C	Potassium persulphate
D	All of the above
Answer	C
Marks	1
Unit	3b1

Id	
Question	Initiator used in solution polymerization is
A	Benzoyl peroxide
B	Acetyl peroxide
C	H ₂ O ₂
D	All of the above
Answer	D
Marks	1
Unit	3b1

Id	
Question	In emulsion polymerization what is responsible for formation of emulsion?
A	Potassium persulphate
B	Sodium salt of fatty acid
C	Hydrogen peroxide
D	All of the above
Answer	B
Marks	1
Unit	3b1

Id	
Question	In emulsion polymerization the monomer polymerizes inside
A	Monomer droplets
B	Micelles
C	Aqueous phase
D	Surface of reactor
Answer	B
Marks	1
Unit	3b1

Id	
Question	Initiator used in emulsion polymerization is soluble in
A	Water
B	Monomer
C	Organic solvent
D	Surfactant
Answer	A
Marks	1
Unit	3b1

Id	
Question	In which technique of addition polymerization only monomer and initiator are used?
A	Solution polymerization
B	Bulk polymerization
C	Emulsion polymerization
D	Suspension polymerization
Answer	B
Marks	1
Unit	3b1

Id	
Question	In which technique of addition polymerization inert solvent is used to dissolve monomer and initiator mixture?
A	Solution polymerization
B	Suspension polymerization
C	Bulk polymerization
D	Emulsion polymerization
Answer	A
Marks	1
Unit	3b1

Id	
Question	In which technique of addition polymerization water insoluble monomer and water soluble initiator are used?
A	Suspension polymerization
B	Bulk polymerization
C	Solution polymerization
D	Emulsion polymerization
Answer	D
Marks	1
Unit	3b1

Id	
Question	The function of stabilizers used in suspension polymerization technique is -----
A	To maintain monomer- initiator mixture in the form of droplet.
B	To act as catalyst.
C	To act as coolant.
D	To reduce surface tension.
Answer	A
Marks	1
Unit	3b1

Id	
Question	The emulsifying agents used in emulsion polymerization technique when added to water extend ----- end towards water.
A	Hydrophobic end
B	Hydrophilic end
C	Hydrocarbon group
D	None of these
Answer	B
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique in which stabilizer is used?
A	Bulk polymerization
B	Suspension polymerization
C	Solution polymerization
D	Emulsion polymerization
Answer	B
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique in which emulsifying agent is used?
A	Solution polymerization
B	Suspension polymerization
C	Emulsion polymerization
D	Bulk polymerization
Answer	C
Marks	1
Unit	3b1

Id	
Question	The function of stabilizers used in suspension polymerization technique is -----
A	To maintain monomer- initiator mixture in the form of droplet.
B	To act as catalyst.
C	To act as coolant.
D	To reduce surface tension.
Answer	A
Marks	1
Unit	3b1

Id	
Question	The role of emulsifying agents used in emulsion polymerization technique is -----
A	To act as initiator.
B	To act as catalyst
C	To act as surfactant.
D	To act as stabilizer.
Answer	C
Marks	1
Unit	3b1

Id	
Question	The emulsifying agents used in emulsion polymerization technique has -----
A	Hydrophilic ends
B	Hydrophobic ends
C	Hydrophilic and hydrophobic ends
D	Hydroxy groups
Answer	C
Marks	1
Unit	3b1

Id	
Question	The emulsifying agents used in emulsion polymerization technique when added to water extends ----- end towards water
A	Hydrophobic end
B	Hydrophilic end
C	Hydroxy group
D	None of these
Answer	B
Marks	1
Unit	3b1

Id	
Question	The emulsifying agents used in emulsion polymerization technique when added to water extend ----- end towards monomer molecule.
A	Hydrophobic end
B	Hydroxy group
C	Hydrophilic end
D	None of these
Answer	A
Marks	1
Unit	3b1

Id	
Question	In active micelle there is inward diffusion of ----- and outward diffusion of ----- is facilitated by surfactant.
A	Monomer molecule, initiator
B	Solvent molecule, monomer molecule
C	Initiator, solvent molecule
D	Initiator, monomer molecule
Answer	D
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique in which high purity and high molecular weight polymer is obtained.
A	Solution polymerization
B	Suspension polymerization
C	Emulsion polymerization
D	Bulk polymerization
Answer	D
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique in which low purity and low molecular weight polymer is obtained.
A	Solution polymerization
B	Suspension polymerization
C	Emulsion polymerization
D	Bulk polymerization
Answer	A
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique in which polymer obtained is in the form of latex.
A	Solution polymerization
B	Suspension polymerization
C	Emulsion polymerization
D	Bulk polymerization
Answer	C
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique in which polymer obtained is in the form of spherical beads.
A	Solution polymerization
B	Suspension polymerization
C	Emulsion polymerization
D	Bulk polymerization
Answer	B
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique in which inert solvent is used.
A	Solution polymerization
B	Suspension polymerization
C	Emulsion polymerization
D	Bulk polymerization
Answer	A
Marks	1
Unit	3b1

Id	
Question	Name the addition polymerization technique if initiator is insoluble in monomer but soluble in water.
A	Solution polymerization
B	Suspension polymerization
C	Emulsion polymerization
D	Bulk polymerization
Answer	C
Marks	1
Unit	3b1

Segment : C :uv-visible spectroscopy

	Question	Marks	Answer
1.	As the concentration increases a) Absorbance increase and transmittance increases. b) Absorbance increase and transmittance decreases. c) Absorbance decrease and transmittance decreases. d) Absorbance decrease and transmittance increases.	1	b
2.	In electromagnetic wave reciprocal of wavelength is -----a) Frequency b) Velocity c) Wave number d) Frequency	1	c
3.	Mathematical form of Beer lamberts law is a) $A = \epsilon c l$ b) $A \propto C$ c) $A \propto l$ d) $A \propto \epsilon$	1	a
4.	According to Beer law absorbance of the solution is a) $A = \epsilon c l$ b) $A \propto C$ c) $A \propto l$ d) $A \propto \epsilon$	1	b
5.	According to Lamberts law ,absorbance of the solution is proportional to provided thatof solution remains constant. a) Concentration, length. b) Length, concentration c) Concentration, p^H d) Length, p^H	1	b
6.	An isolated functional group capable of absorbing UV radiations are called ---- a)chromophore b)auxochrome c)hypochrome d)hypsochrome	1	a
7.	If absorption of molecule is shifted towards longer wavelength due to solvent effect then it is called ----a)hypsochromic shift b)hypochromic shift c)bathochromic shift d)hyperchromic shift	1	c
8.	Maximum energy is required for transition of ----a) $\sigma \rightarrow \sigma^*$ b) $\pi \rightarrow \pi^*$ c) $n \rightarrow \pi^*$ d) $n \rightarrow \sigma^*$	1	a

9.	Minimum energy is required for transition of ---a) $\sigma \rightarrow \sigma^*$ b) $\pi \rightarrow \pi^*$ c) $n \rightarrow \pi^*$ d) $n \rightarrow \sigma^*$	1	c
10.	In electromagnetic spectrum, the visible region is----- a)200-400nm	1	b

	b)400-800nm c) 800-900nm d)100-200nm		
11.	A group of atoms in a molecule responsible for absorption of radiation is called as ----- a) chromophore b) auxochrome c) chromosome d) parent molecule	1	a
12.	$\pi \rightarrow \pi^*$ transitions are associated with compound containing ----a)alkenes b)aromatic compounds c) alkynes d)all of the above	1	d
13.	Which of the following is a chromophore -----a)C-OH b) C-Br c) C=O d) C-NH ₂	1	c
14.	For the study of UV/visible spectroscopy, two types of spectrophotometers are used , namely ----- a) single & double beam b) single & double bond c) double & triple beam d) double & triple bond	1	a
15.	Electromagnetic spectrum below 200nm is known as ---a) near UV region b)far UV region c)visible region d)microwave region	1	b
16.	Which of the following is not a chromophore? a)C=C b)C=O c)-N=N- d)C-OH	1	d

17.	When absorption maxima shifts towards longer wavelength due to presence of auxochrome, is called ----a) bathochromic shift b) red shift c) both a & b d) neither a nor b	1	c
18.	Transmittance is defined by the equation ----- a) $T = \frac{I}{I^0}$ b) $A = -\log T$ c) $T = A^{-10}$ d) $T = 10^{\epsilon bc}$	1	a
19.	Unit of molar extinction coefficient is a) $\text{Lit mole}^{-1} \text{cm}^{-1}$	1	c

	b) $\text{Lit mole}^{-1} \text{cm}^{-1}$ c) $\text{Lit mole}^{-1} \text{cm}^{-1}$ d) $\text{Lit mole}^{-1} \text{cm}^{-1}$		
20.	In electromagnetic spectrum, the UV region is-----a) $2000-4000 \text{\AA}^0$ b) $4000-8000 \text{\AA}^0$ c) $8000-9000 \text{\AA}^0$ d) $1000-2000 \text{\AA}^0$	1	a
21.	Absorbance is related to transmittance as -----a) $A = -\ln T$ b) $A = -\log T$ c) $A = +\log T$ d) $A = +\ln T$	1	b
22.	Intensity of a monochromatic beam is proportional to the number of ----- incident on unit area in unit time. a) electrons & protons b) positive & negative ions c) photons d) neutrons	1	c
23.	According to Beer-Lamberts law, absorbance, A, of the solution is ----a) $A = a^2bc$ b) $A = -\epsilon \cdot b \cdot c$ c) $A = -a^2bc$ d) $A = \epsilon \cdot b \cdot c$	1	d
24.	Intensity of a beam is the energy falling on unit area perpendicular to the beam per ----- a) unit length b) unit time c) unit weight d) unit volume	1	b

25.	According to Beer-Lamberts law, intensity of beam of monochromatic radiation decreases -----a)suddenly b)very slowly c)exponentially d)moderately	1	c
26.	Relationship between optical density and Transmittance is a) $A \propto \log T$. b) $A \propto T$. c) $A \propto \log T$. d) $A \propto \log (1/T)$.	1	a
27.	Beer-Lamberts law is not obeyed if radiation used is not ----a)bright b)uniform c)monochromatic d)polychromatic	1	c
28.	The UV spectrophotometer can use sample which are-----a)crystalline b)amorphous	1	c

	c)in the form of solution d)in the form of sublimates		
29.	For UV spectroscopy, cuvettes used are not made up of ----a) silica b)quartz c) glass d) both a & b	1	c
30.	Which one is the application of UV spectroscopy? a)Detection of impurities b)Geometry of metal complexes c)chemical kinetics d)all of these.	1	b
31.	Absorption of UV and visible radiation in organic molecules is restricted to certain groups called -----a) chromophore b) auxochrome c) chromosome d) selective group	1	a
32.	Which of the following transition in UV/visible region is not possible? a) $\sigma \rightarrow \sigma^*$ b) $n \rightarrow \sigma^*$ c) $\pi \rightarrow \pi^*$ d) $\sigma \rightarrow n^*$	1	d

33.	$\sigma \rightarrow \sigma^*$ transitions absorb radiations in the region -----a)above200nm b)below 180nm c)at 200nm d)above 400nm	1	b
34.	As compared to $\sigma \rightarrow \sigma^*$ transitions, energy required for $n \rightarrow \sigma^*$ transition is --- - a)more b)equal c)less d)very high	1	c
35.	Unsaturated compounds containing hetero atoms such as O,N and S, show ---- ---- transitions. a) $n \rightarrow \sigma^*$ b) $n \rightarrow \pi^*$ c) $\pi \rightarrow \pi^*$ d) $\sigma \rightarrow \sigma^*$	1	b
36.	The correct equation for transmittance is -----a) $A=$ $\epsilon b c$ b) $A= \log (I_0/ I)$ c) $T= 10^{-\epsilon bc}$ d) $T= A^{-10}$	1	c
37.	Compound containing chromophore is called as -----a)chromophene b)auxigen c)auxochrome d)chromogen	1	d
38.	When absorption maxima of a compound shifts to shorter wavelength, it is known as ----- shift.	1	a

	a)hypsochromic b)hyperchromic c)hypochromic d)bathochromic		
39.	A group of atoms in a molecule responsible for imparting colour to the compound is called as -----a) chromophore b) auxochrome c) chromosome d) parent molecule	1	a
40.	In UV-visible spectroscopy which instrument gives higher instrumental error? a)double beam b)single beam c)same in both d)no error in both	1	b

41.	According to Lambert's law as thickness of sample increases arithmetically, amount of transmitted light -----a) decreases arithmetically b) increases arithmetically c) decreases exponentially d) increases exponentially	1	c
42.	Which of the following statement is true in case of auxochrome? a) auxochrome absorb radiation in near UV region. b) auxochrome absorb radiation & bring about $\pi \rightarrow \pi^*$ transitions c)auxochrome does not absorb radiation in near uv region. d) auxochrome absorb radiation & bring about $n \rightarrow \pi^*$ transitions	1	c
43.	$n \rightarrow \pi^*$ transition can occur in compounds containing a) double bond b) double bond involving hetero atom. c) triple bond d) atoms with lone pairs.	1	b
44.	When absorption maxima shifts towards lower wavelength due to removal of conjugation, it is called -----a)red shift b)orange shift c)blue shift d)black shift	1	c
45.	UV-visible spectrum is a plot of -----a) radiation Vs Absorbance b) wavelength Vs concentration c) Absorbance Vs concentration d)Absorbance Vs wavelength	1	d
46.	In absorption spectroscopy,Beer's law can be mathematically expressed as ----- a) $\ln I_0 / I = \text{path length}$ b) Absorbance = conc. \times path length c) $\ln I_0 / I = \text{concentration}$ d)Transmittance = concentration	1	c
47.	In absorption spectroscopy, Lambert's law can be mathematically expressed as ----- a) $\ln I_0 / I = \text{path length}$ b) Absorbance = conc. \times path length c) $\ln I_0 / I = \text{concentration}$	1	a

	d)Transmittance = concentration		
48.	In the equation, $A = \epsilon b c$, ' ϵ ' is called -----a)adsorption coefficient b)extinction coefficient c)desorption coefficient d)excitation coefficient	1	b

49.	When absorption intensity of a compound is increased, the effect is known as - ----- a)hypsochromic shift b)hypochromic shift c)bathochromic shift d)hyperchromic shift	1	d
50.	Which of the following is not an auxochrome? a) $-\text{CH}_3$ b) $\text{HC}=\text{CH}$ c) $-\text{NHCH}_3$ d) $-\text{SO}_3\text{H}$	1	b
51.	Change in the position and change in the intensity of absorption band of a chromophore is caused by ----a)autochrome b)solvent c)auxochrome d) high temperature	1	c
52.	52) Absorption bands in absorption spectrum correspond to ----within molecule. a)substituent b) bulky group c)structural group d)) none above	1	c
53.	Peaks resulting from n- σ^* transitions are shifted to shorter wavelength with increasing solvent polarity, known as -----a)Black shift b)red shift c) violet shift d) blue shift	1	d
54.	BLUE shift is due to increase in----- that lowers energy of the 'n' orbital a)polarity b) solvation of lone pair c) intensity of radiation d) none above	1	b
55.	Absorption of ultraviolet and visible radiations in organic molecule is restricted to certain ----- a) Substituent b) bulky group c) additional group d) functional group	1	d
56.	When absorption maxima shifts towards lower wavelength due to change in the polarity of the solvent, it is called -----a)hypsochromic shift b)hypochromic shift c)bathochromic shift d)hyperchromic shift	1	a

57.	Instead of glass, quartz cuvettes and quartz windows are used in UV-visible spectroscopy because ----- a) glass absorbs radiation of wavelength less than 350nm. b) glass is breakable c) quartz looks elegant d) quartz is cheaper than glass	1	a
58.	Which of the following is an auxochrome? a) – NH ₂ b) –COOH c) –OCH ₃ d) all of them	1	d
59.	$\sigma \rightarrow \sigma^*$ transitions are seen in -----a) ethers and esters b) aldehydes and ketones c) saturated hydrocarbons d) alcohols and amines	1	c
60.	Intensity of light absorbed, I_a , is given by ----a) $I_a = I_0 - I_t^2$ b) $I_a = I_0 - I_t$ c) $I_a = I_t - I_0$ d) $I_a = I_t - I_0^2$	1	b
61.	According to Beer's law as concentration of sample increases arithmetically, amount of transmitted light -----a) decreases arithmetically b) increases arithmetically c) decreases exponentially d) increases exponentially	1	c
62.	UV region in electromagnetic spectrum comprises of wavelengths ranging from ----- a) 200-400nm b) 400-800nm c) 2.5- 15 μm d) 10 – 1000 \AA	1	a
63.	When compound containing chromophore absorbs uv-visible radiations the energy associated with them can bring about -----a) rotation of bonds b) electronic excitations c) vibration of bonds d) breaking of bonds	1	b
64.	Which of the following is not a chromophore? a) C=C b) C=O c) C-N d) N=O	1	c

65.	$\pi \rightarrow \pi^*$ transitions will not be possible in -----a) benzene b)ethane c)ethylene d)HCHO	1	b
66.	Which of the following is not a auxochrome? a) C=C b) -NH ₂ c) -OH d) -Cl	1	a
67.	The Lambert-Beer law of absorption by solution is -----a) $\ln I_0 / I = \text{path length}(x)$ b) $A = \epsilon I c$ c) $\ln I_0 / I = \text{concentration}$ d) Transmittance = concentration	1	b
68.	$n \rightarrow \pi^*$ electronic excitation is possible in case of molecule having ----- structural part. a) C=C b) -C \equiv C- c) C=O d) C=C-Cl	1	d
69.	The highest amount of energy is required for electronic transition -----a) $\sigma \rightarrow \sigma^*$ b) $n \rightarrow \pi^*$ c) $\pi \rightarrow \sigma^*$ d) $\pi \rightarrow \pi^*$	1	a
70.	Which of the following is a auxochrome? a) C-N b) C-O c) -OH d) C=C	1	c
71.	Energy of electron is lowest when it is in ----- molecular orbital. a) π b) σ c) π^* d) π	1	b
72.	The detector used in UV-visible spectrophotometer is ----- a)phototube b)photomultiplier tube c)photovoltaic cell d)all of these	1	d

73.	The energy of photon is depends on ----- a)wave number b)frequency c)type of radiation d)type of transition	1	b
74.	----- region lies between visible and microwave region in electromagnetic spectrum. a) X-ray b)radio waves c)infra-red	1	c

	d)ultra-violet		
75.	There are ----- types of discrete energy levels present in molecules like atoms. a)four b)two c)five d)three	1	d
76.	Absorption spectroscopy based on colour concentration of solution is known as ----- a) photometry b) colorimetry c)potentiometry d)conductometry	1	b
77.	Methane when absorbs electromagnetic radiation from uv region, it undergoes ----- type of transition. a) $\sigma \rightarrow n^*$ b) $\pi \rightarrow \pi^*$ c) $\sigma \rightarrow \sigma^*$ d) $\sigma \rightarrow \pi^*$	1	c
78.	The energy of photon is obtained by -----a) $1/\lambda$ b) $h \cdot \gamma$ c) $\lambda \cdot \gamma$ d) λ / γ	1	b
79.	Useful region of UV in spectral analysis comprises of radiation having wavelength ----- a) 10-200 nm b) 200-400nm c) 400-800nm d) 100-200nm	1	b

80.	In UV spectroscopy common solvent used in the preparation of sample to be analysed is ----- a) dil. HCl b) chloroform c) ethyl alcohol d) benzene	1	c
81.	In case of σ , π and lone pair electrons, how many electronic transitions are forbidden transitions? a) three b) two c) five d) zero	1	b
82.	Light source used in uv spectroscopy is ----- a) hydrogen lamp b) halogen lamp c) helium lamp	1	a

	d) Na vapor lamp		
83.	Monochromator used in uv spectroscopy is ----- a) glass prism b) Quartz grating c) glass plate d) laser	1	b
84.	When absorption intensity of a compound is decreased, the effect is known as ----- effect. a) bathochromic b) hypochromic c) hyperchromic d) hypsochromic	1	c
85.	Alkenes when absorb UV radiation, they undergo ----- electronic transition. a) $\sigma \rightarrow \pi^*$ b) $\pi \rightarrow n^*$ c) $\sigma \rightarrow \sigma^*$ d) $\pi \rightarrow \pi^*$	1	d

CaCO_3 equivalent of salt = Weight of salt in mg * 50/ equivalent weight of salt

= CaCO_3 equivalent of salt

CaCO_3 equivalent $\text{Ca}(\text{HCO}_3)_2 = 6.4 * 50 / 81$

= 3.9 mg CaCO_3 equivalent

CaCO_3 equivalent of $\text{Mg}(\text{HCO}_3)_2 = 8.2 * 50 / 73$

5.61 mg CaCO_3 equivalent

CaCO_3 equivalent of $\text{MgSO}_4 = 5.6 * 50 / 60$

= 4.66 mg CaCO_3 equivalent

CaCO_3 equivalent of $\text{MgCl}_2 = 4.2 * 50 / 47.5$

= 4.42 mg CaCO_3 equivalent

CaCO_3 equivalent of $\text{CaSO}_4 = 12.3 * 50 / 68$

= 9.04 mg CaCO_3 equivalent

Temporary hardness = 3.9 + 5.61 = 9.51 mg CaCO_3 equivalent

Permanent Hardness = 4.66 + 4.42 + 9.04 = 18.12 mg CaCO_3 equivalent

Total hardness = 9.51 + 18.12 = 27.63 mg CaCO_3 equivalent

1. 20 ml standard hard water contain 14 gm CaCO_3 per lit. 20 ml of this required 22 ml EDTA for the end point. 100 ml of water sample required 15 ml EDTA solution. The same sample after boiling required 10 ml of EDTA solution Calculate carbonate and noncarbonate hardness of water.

Solution – 1 liter of standard hard water contain 14 gm CaCO_3 equivalent hardness.
= 14000 mg CaCO_3 equivalent hardness

1 ml of std hard water contain = 14 mg CaCO_3 equivalent hardness

20 ml std hard water contain = $20 * 14 = 280$ mg CaCO_3 equivalent hardness

20 ml hard water sample requires 22 ml EDTA for end point

20 ml hard water = 22 ml EDTA = 280 mg CaCO_3 equivalent hardness

1ml EDTA = $280 / 22 = 12.72$ mg CaCO_3 equivalent hardness

100 ml water sample requires 15 ml EDTA solution for end point

= $15 \times 12.72 = 190.8$ mg CaCO₃ equivalent hardness

1000 ml water sample contain = $1000 \times 190.8 / 100 = 1908$ mg CaCO₃ equivalent hardness

Total hardness = 1908 mg CaCO₃ equivalent.

Volume of edta required for 100 ml hard water after boiling and filtration = permanent hardness

10 ml edta = $10 \times 12.72 = 127.2$ mg CaCO₃ equivalent hardness

100 ml hard water contain 127.2 mg CaCO₃ equivalent hardness

1000 ml hard water require = $1000 \times 127.2 / 100$

= 1272 mg CaCO₃ equivalent hardness

Permanent/non carbonate hardness = 1272 mg CaCO₃ equivalent

Temporary/ carbonate hardness = total hardness – Permanent hardness

= $1908 - 1272 = 636$ mg CaCO₃ equivalent

2. A sample water of 100 ml required 12.6 ml of 0.02 M EDTA solution with erichrome black T as an indicator and 8.4 ml of 0.02 M EDTA for 100 ml of water from the same source after removing the carbonate hardness

- Volume of water sample = $V = 100$

ml - Molarity of EDTA = $Z = 0.02$ M

Total hardness = $(y_1/V) \times Z \times 100 \times 1000$

$(12.6/100) \times 0.02 \times 100 \times 1000$

= 252 ppm CaCO₃ equivalent hardness

Permanent hardness = $(y_2/V) \times Z \times 100 \times 1000 = (8.4/100) \times 0.02 \times 100 \times 1000$

= 168 ppm CaCO₃ equivalent hardness

3. 50 ml water sample requires 4.5 ml of N/50 H₂SO₄ upto phenolphthalein end point and another 6 ml upto methyl orange end point, compute alkalinity result.

Solution –

Volume of alkaline water sample = $V = 50$ ml

Normality of H₂SO₄ = $N/50 = 1/50 = 0.02$ N

Volume of N/50 H₂SO₄ upto phenolphthalein end point = $v_1 = 4.5$ ml

Volume of N/50 H₂SO₄ upto methyl orange end point = $4.5 + 6 = 10.5$ ml

P = Phenolphthalein alkalinity = $V_1 \times 0.02 \times 50 \times 1000 / V$

$$= 4.5 \times 0.02 \times 50 \times 1000 / 50$$

$$= 90 \text{ ppm CaCO}_3 \text{ equivalent}$$

$$M = \text{methyl orange alkalinity} = v_2 \times 0.02 \times 50 \times 1000 / V$$

$$= 10.5 \times 0.02 \times 50 \times 1000 / 50$$

$$= 210 \text{ ppm CaCO}_3 \text{ equivalent}$$

Comparing values of P and M we found that, $P < (1/2)M$

Hence, CO_3^{2-} and HCO_3^- ions are present

$$\text{CO}_3^{2-} \text{ alkalinity amount} = 2P = 2 \times 90 = 180 \text{ ppm CaCO}_3 \text{ equivalent}$$

$$\text{HCO}_3^- \text{ alkalinity amount} = M - 2P = 210 - 180 = 30 \text{ ppm CaCO}_3 \text{ equivalent}$$

4. **A water sample is not alkaline to phenolphthalein .100ml of sample on titration with N/50 HCl required 17.5 ml to get methyl orange end point.**

compute alkalinity result.

Solution =

$$\text{Volume of water sample} = V = 100 \text{ ml}$$

$$\text{Normality of acid} = N/50 = 0.02N$$

$$\text{Volume of acid upto phenolphthalein end point} = v_1 = 0 \text{ ml}$$

$$\text{Volume of acid upto methyl orange end point} = v_2 = 17.5 \text{ ml}$$

$$P = 0$$

$$\text{Methyl orange alkalinity} = M = v_2 \times 0.02 \times 50 \times 1000 / 100$$

$$= 17.5 \times 0.02 \times 50 \times 1000 / 100$$

$$175 \text{ ppm CaCO}_3 \text{ equivalent}$$

From the values of P and M, we found that, $P = 0$

Hence only HCO_3^- alkalinity is present

Hence HCO_3^- alkalinity = M = 175 ppm CaCO_3 equivalent.

5. A zeolite bed was exhausted on softening of 4000 litre of water requires 10 litres of 15 % NaCl solution for regeneration. Calculate hardness of water sample.

Solution –

$$15\% \text{ NaCl} = 15 \text{ gm NaCl in } 100 \text{ ml water}$$

$$= 150 \text{ gm NaCl in } 1000 \text{ ml water}$$

$$10 \text{ litre of } 15\% \text{ NaCl} = 150 \times 10 = 1500 \text{ gm NaCl}$$

$$= 1500 \times 1000 = 1500000 \text{ mg NaCl}$$

$$= 1.5 \times 10^6 \text{ mg NaCl}$$

CaCO₃ equivalent of NaCl = mg of NaCl * 50 / equivalent wt of NaCl

$$= 1.5 \times 10^6 \times 50 / 58.5$$

$$= 1.282051 \times 10^6 \text{ mg CaCO}_3 \text{ equivalent NaCl.}$$

$$\text{Hardness per litre} \times \text{litre of hard water} = 1.282051 \times 10^6$$

$$\text{Hardness per litre} \times 4000 = 1.282051 \times 10^6$$

$$\text{Hardness per litre} = 1.282051 \times 10^6 / 4000$$

$$= 320.51 \text{ ppm CaCO}_3 \text{ equivalent}$$

6. A Zeolite softner was completely exhausted and was regenerated by passing 100 litre of NaCl containing 120 gm/litre of NaCl. How many litre of sample of water having hardness 500 ppm can be soften by this softner ? Solution –

strength of NaCl = 120/litre

$$= 100 \text{ litre of NaCl solution contain} = 100 \times 120 = 12000 \text{ gm NaCl}$$

$$= 12000 \times 1000 = 1.2 \times 10^7 \text{ mg}$$

CaCO₃ equivalent of NaCl = mg of NaCl * 50 / 58.5

$$= 1.2 \times 10^7 \times 50 / 58.5$$

= 1.02564102 * 10⁷ mg CaCO₃ equivalent of NaCl

$$\text{Hardness per litre} \times \text{litre of hard water} = 1.02564102 \times 10^7$$

$$500 \times \text{litre of hard water} = 1.02564102 \times 10^7$$

$$= \text{litre of hard water} = 1.02564102 \times 10^7 / 500$$

$$= 20512.8 \text{ litres.}$$

7. A zeolite bed was exhausted after removing completely the total hardness of 20000 litres of water. It required regeneration with 150 litres of solution containing 100 gm/l. calculate the hardness of water.

$$\text{Hardness of water} = 641.02 \text{ mg/litre}$$

8. The coal containing 5% hydrogen (dry / moisture free basis) and 10% moisture has gross calorific value of 33.5 MJ/kg. Calculate Net Calorific Value of Coal. Latent heat of water vapour is 2.45 MJ/kg.

$$\text{Weight of coal is 1 kg}$$

$$1 \text{ MJ} = 1000 \text{ KJ}$$

$$\text{GCV} = 3350 \text{ KJ}$$

$$\text{NCV} = \text{GCV} - 0.09 \times \%H \times 587 \text{ KJ/mol}$$

$$\text{NCV} = \text{GCV} - 0.09 \times 5 \times 587$$

$$\text{NCV} = 33500 - 264.15$$

$$\text{NCV} = 33235.85 \text{ KJ/mol}$$

9. 0.72 g of a fuel containing 80% Carbon, when burnt in a bomb calorimeter, increased the temperature of water from 27.3°C to 29.1°C. If the calorimeter contains 250 g of water and its water equivalent is 150 g, calculate GCV of the fuel

Solution –

$$\text{Weight of fuel} = 0.72 \text{ gm} = x$$

$$\text{Rise in temperature} = T_2 - T_1 = 29.1 - 27.3 = 1.8^\circ\text{C}$$

$$\text{Weight of water} = W = 250 \text{ gm}$$

$$\text{Weight of water equivalent} = w = 150 \text{ gm}$$

$$\begin{aligned}\text{GCV} &= (W+w)(T_2-T_1)/x \\ &= (250+150)(1.8)/0.72\end{aligned}$$

$$\text{GCV} = 1000 \text{ Cal/gm}$$

A sample of coal containing 5% H when allowed to undergo combustion in Bomb Calorimeter, the following data were obtained

1. weight of coal burnt = 0.95 g
2. weight of water taken = 700 g
3. water equivalent of bomb calorimeter = 2000 g
4. rise in temperature = 2.48 °C
5. cooling correction = 0.02 °C
6. fuse wire correction = 10 cal
7. acid correction = 60 cal

Calculate Gross and Net Calorific Value of Coal.

Solution –

$$\text{Weight of coal burnt} = 0.95 \text{ gm} = x$$

$$\text{Weight of water taken} = 700 \text{ gm} = W$$

$$\text{Water equivalent of bomb calorimeter} = 2000 \text{ gm} = w$$

$$\text{Rise in temperature} = t_2 - t_1 = 2.48^\circ\text{C}$$

Cooling correction = $T_c = 0.02\text{ }^{\circ}\text{C}$

Fuse wire correction = $f = 10\text{ cal}$ Acid
correction = $a = 60\text{ cal}$

$$\begin{aligned}\text{GCV} &= (W+w)(T_2 - T_1 + T_c) - (a+f)/x \\ &= (700+2000)(2.48+0.02) - (10+60)/0.95 \\ &= 7031.5\text{ cal/gm}\end{aligned}$$

$$\begin{aligned}\text{NCV} &= \text{GCV} - 0.09 \times \%H \times 587\text{ cal/gm} \\ &= 7031.5 - 0.09 \times 5 \times 587\end{aligned}$$

$$\text{NCV} = 6767.35\text{ cal/gm}$$

Sr. No.	Question	Option	Mks	Gr
1.	Water which does not form lather readily with soap is called as a) Soft water b) Pure water c) Impure water d) Hard water	d	1	A
2.	Temporary hardness is also known a) carbonate hardness b) non-carbonate hardness c) total hardness d) none of above	a	1	A
3.	Permanent hardness is also known as a) carbonate hardness b) non-carbonate hardness c) total hardness d) none of above	b	1	A
4.	The concentration of dissolved impurities is expressed in terms of a) equivalents of Na_2CO_3 b) equivalents of CaCO_3 c) equivalents of MgCO_3 d) equivalents of ZnSO_4	b	1	A
5.	10 mg/lit is equal to a) 0.1 ppm b) 1ppm c) 10 ppm d) 100ppm	c	1	A
6.	Hardness of water is its a) Soap releasing capacity b) Soap forming capacity c) Soap consuming capacity d) Soap dissolving capacity	b	1	A
7.	Hardness of water is determined by a) EDTA method b) Volhard's method c) Mohr's method d) Iodometric titration method	a	1	A

8.	EDTA method used to determine hardness of water is a a) Precipitation titration b) Redox titration c) Complexometric titration d) Acid-base titration	c	1	A
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9.	In the determination of hardness of water, Na_2EDTA is preferred instead of EDTA because a) EDTA is volatile. b) EDTA is very cheap. c) EDTA is colorless. d) EDTA is partially soluble in water.	d	1	A
10.	Indicator used in EDTA method to determine hardness of water is a) Thymol blue b) Alizarin Yellow R c) Eriochrome Black T d) Bromocresol red	c	1	A
11.	In the determination of hardness of water by EDTA method, buffer added is of pH a) 9 b) 8 c) 12 d) 10	d	1	A
12.	In the determination of hardness of water by EDTA method, the endpoint is a) colourless to pink b) yellow to orange c) blue to wine red d) wine red to blue	d	1	A
13.	1 M $\text{Na}_2\text{EDTA} \equiv$ _____ CaCO_3 . a) 10 g b) 100 g c) 1000 g d) None of these	b	1	A
14.	In EDTA titration, the addition of buffer solution maintains a) Alkalinity b) Acidity c) pH d) Neutrality	d	1	A

15.	The colour of Metal-EDTA complex is a) Blue b) Wine red c) Pink d) colourless	d	1	A
16.	Metal-EBT complex is a) Blue coloured b) Wine red coloured c) Pink coloured d) colourless	b	1	A
17.	Hydroxide alkalinity of water is determined by using indicator a) Methyl orange b) Phenolphthalein c) Phenol red d) Cresol red	b	1	A

18.	In alkalinity experiment, phenolphthalein end point is a) Pink to colourless b) Yellow to red c) Colourless to pink d) None of these	a	1	A
19.	Alkalinity of water is due to a) OH^- b) CO_3^{2-} c) HCO_3^- d) All of these	d	1	A
20.	If $P = M$, then alkalinity of water is due to ions a) OH^- b) HCO_3^- c) CO_3^{2-} d) OH^- and CO_3^{2-}	a	1	A
21.	Determination of Alkalinity is a type of titration known as a) Precipitation b) Redox c) Complexometric d) Acid-base	d	1	A
22.	Bicarbonate alkalinity of water is determined by using indicator a) Methyl orange b) Phenolphthalein c) Phenol red d) Cresol red	a	1	A

23.	Carbonate alkalinity of water is determined by using indicators in the sequence a) Methyl orange and Phenolphthalein b) Phenolphthalein and Methyl orange c) Phenolphthalein and Phenol red d) Cresol red and Methyl orange	b	1	A
24.	The permitted hardness of water for low pressure boilers is a) 25-50 ppm b) 10-25 ppm c) 0-2 ppm d) None of the above	a	1	A
25.	The permitted hardness of water for high pressure boilers is a) 25-50 ppm b) 10-25 ppm c) 0-2 ppm d) None of the above	c	1	A
26.	The permitted hardness of water for medium pressure boilers is a) 25-50 ppm b) 10-25 ppm c) 0-2 ppm d) None of the above	b	1	A

27.	Priming is the formation of a) Wet steam b) Dry steam c) Super heated steam d) Bubbles on the surface of water	a	1	A
28.	Violent or vigorous boiling leads to formation of a) Priming b) Foaming c) Super heated steam d) None of the above	b	1	A
29.	Violent or vigorous boiling leads to formation of a) Sludge b) Scale c) Priming and foaming d) Caustic embrittlement	b	1	A

30.	Priming is caused due to a) High steam velocities b) Level of water beyond the safe limits. c) Presence of suspended impurities in boiler water. d) All of the above	c	1	A
31.	Foaming is caused due to: a) Surface tension of water is lowered due to presence of clay. b) Presence of Oil or grease in make-up water. c) Violent agitation of boiler feed water. d) All of the above.	d	1	A
32.	Priming and foaming is controlled by a) Use of untreated water. b) Satisfying sudden steam demands. c) Avoiding the addition of anti-foaming agents d) None of the above	d	1	A
33.	Foaming can be prevented by adding antifoaming agents like e) Castor oil f) Lubricating oil g) Sunflower oil h) Soyabean oil	a	1	A
34.	Oil impurities can be removed by adding a) Sodium chloride b) Sodium aluminate c) Sodium hydroxide d) Sodium sulphate	b	1	A
35.	Blow down operation is a) Removing hot steam from boilers b) Removing dissolved impurities from boiler water c) Removing hot water having higher concentration of impurities from boiler d) All of the above	c	1	A

36.	Blow down operation is followed by a) Make up water b) Brush up water c) Softening of water d) Potable water	a	1	A
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37.	Dissolved oxygen can be removed by adding calculated quantity of a) Sodium carbonate b) Sodium bicarbonate c) Sodium sulphate d) Sodium sulphite	d	1	A
38.	Dissolved carbon dioxide in water forms a) Carbon monoxide b) Carbonic acid c) Hydrogen dioxide d) Carbonate of calcium	b	1	A
39.	Carbon dioxide dissolved in water can be removed by adding calculated quantity of a) Liquid ammonia b) Hydrazine c) Sodium sulphide d) Sodium carbonate	a	1	A
40.	Corrosion of boilers due to dissolved carbon dioxide can be prevented completely by a) Removing dissolved gases by mechanical deareators b) Using soft water c) Adding ammonia d) Adding alum to water	c	1	A
41.	Corrosion of boilers due to dissolved oxygen can be prevented completely by a) Removing dissolved gases by mechanical deareators b) Using soft water c) Adding ammonia d) Adding alum to water	a	1	A
42.	MgCl ₂ impurity present in boiler water is deposited as a) MgCO ₃ b) Mg(OH) ₃ c) Mg(HCO ₃) ₂ d) Mg(OH) ₂	d	1	A
43.	The loose and slimy precipitate formed in the boiler is known as a) Sludge b) Scale c) Coat d) Layer	a	1	A
44.	Scales are formed in boilers due to a) Decomposition of bicarbonates b) Decrease in solubility of calcium sulphate c) Hydrolysis of magnesium salts d) All of the above	d	1	A

45.	The hard and sticky precipitate formed in the boiler is known as a) Sludge b) Scale c) Coat d) Layer	b	1	A
46.	The decomposition of $\text{Ca}(\text{HCO}_3)_2$ leads to formation of a) CaCO_2 b) CaO c) CO_2 d) CO	c	1	A
47.	Caustic embrittlement can be avoided if water is softened by using a) Sodium carbonate b) Sodium phosphate c) Zeolite softener d) Sodium sulphite	b	1	A
48.	Caustic embrittlement can be avoided by adding to boiler feed water a) Lignite b) Castor oil c) Sodium phosphate d) Lignin	d	1	A
49.	Caustic embrittlement occur due to formation of a) Concentration cell b) Galvanic cell c) Fuel cell d) Rechargeable cell	a	1	A
50.	Corrosion of boilers occur due to water containing the impurity a) Dissolved oxygen b) Dissolved carbondioxide c) Dissolved magnesium chloride d) All of the above	d	1	A
51.	Corrosion of boilers occur due to water containing the impurity a) Dissolved nitrogen b) Dissolved hydrogen c) Dissolved silica d) None of the above	d	1	A
52.	Dissolved sodium hydroxide in boiler water leads to a) Priming and foaming b) Caustic embrittlement c) Corrosion d) Scale and sludge formation	b	1	A

53.	Trace amount of dissolved magnesium chloride in boiler water leads to a) No corrosion b) Excessive corrosion c) Alkalinity d) None of the above	b	1	A
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54.	Scale and sludge are a) Good conductors of heat b) Bad conductors of heat c) Helps transfer of heat d) Permits transfer of gases	b	1	A
55.	M-EDTA complex is a) Neutral b) Negatively charged c) Positively charged d) None of above	b	1	A
56.	Equivalent weight of CaCO_3 is a) Equal to its molecular weight b) Half its molecular weight c) Double its molecular weight d) None of the above	b	1	A
57.	Structure of zeolite has framework of a) Tetrahedral SiO_2 b) Tetrahedral Na_2O c) Tetrahedral Al_2O_3 d) Tetragonal SiO_2	a	1	A
58.	Cation exchange resins are regenerated by a) Hot solution b) Cold solution c) Acidic solution d) Alkaline solution	c	1	A
59.	Anion exchange resins are regenerated by a) Hot solution b) Cold solution c) Acidic solution d) Alkaline solution	d	1	A

60.	Life of semipermeable membrane used for RO has life of a) 2 years b) 4 years c) 6 years d) 8 years	a	1	A
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61.	Sludges are removed by a) Wire brushes b) Hammer and chisel c) Shock treatment d) All of the above	d	1	A
62.	Due to scale formation in boilers there is a) Fuel wastage b) Monitoring of fuel c) Fuel saving d) Fuel blasting	a	1	A
63.	Sludge formed in boilers accumulate in areas that have a) Plain surfaces b) Poor circulation of water c) Good circulation of water d) All of the above	b	1	A
64.	To avoid scale formation chemicals added to boiler water are a) Sodium carbonates b) Sodium sulphides c) Sodium phosphates d) Sodium sulphites	c	1	A
65.	Increase in temperature of water decreases the solubility of a) MgSO_4 b) Na_2SO_4 c) CaSO_4 d) ZnSO_4	c	1	A
66.	Ill effects of scale formation in boilers are a) Wastage of fuel b) Overheating of boilers c) Lowering safety of boilers d) All of the above	d	1	A

Sr. No.	Question	Option	Mks	Gr
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1.	Conditioning of boiler means a) Treatment given to prevent scale formation b) Treatment given to help scale formation c) Treatment given to prevent steam formation d) Treatment given to prevent blow down operation	a	1	B
2.	Prevention of scale formation is achieved by a) Colloidal conditioning b) Calgon conditioning c) Phosphate conditioning d) All of the above	d	1	B
3.	Colloidal conditioning in boilers is done using a) Agar-agar b) Kerosene c) Tannin d) All of the above	d	1	B
4	Scale forming impurities are forced to remain soluble in water by the conditioning process known as a) Colloidal conditioning b) Calgon conditioning c) Phosphate conditioning d) All of the above	b	1	B
5	Calgon is commercial name of a) Sodium dihydrogen phosphate b) Disodium hydrogen phosphate c) Sodium pyro phosphate d) Sodium hexa meta phosphate	d	1	B
6	Sodium hexa meta phosphate is known as a) Calcite b) Magnate c) Calgon d) Permutit	c	1	B
7	If water is highly alkaline the phosphate conditioning of boiler is done using a) Sodium di hydrogen phosphate b) Disodium hydrogen phosphate c) Tri sodium phosphate d) Sodium hexa meta phosphate	a	1	B
8	If water is acidic the phosphate conditioning of boiler is done using a) Sodium di hydrogen phosphate b) Disodium hydrogen phosphate c) Tri sodium phosphate d) Sodium hexa meta phosphate	c	1	B

9	<p>If water is weakly alkaline the phosphate conditioning of boiler is done using</p> <ul style="list-style-type: none"> a) Sodium di hydrogen phosphate b) Disodium hydrogen phosphate c) Tri sodium phosphate d) Sodium hexa meta phosphate 	b	1	B
10	<p>Zeolite is also known as</p> <ul style="list-style-type: none"> a) Feldspar b) Permutit c) Mica d) Brine 	b	1	B
11	<p>Sodium zeolite or permutit can be presented as</p> <ul style="list-style-type: none"> a) $Mg_2O \cdot Al_2O_3 \cdot xSiO_2 \cdot yH_2O$ b) $Na_2O \cdot Al_2O_3 \cdot xSiO_2 \cdot yH_2O$ c) $Ca_2O \cdot Si_2O_3 \cdot xNa_2O \cdot yH_2O$ d) $Si_2O \cdot Al_2O_3 \cdot xK_2O \cdot yH_2O$ 	b	1	B
12	<p>Zeolite process cannot be used for removal of</p> <ul style="list-style-type: none"> a) Ca salts b) Mg salts c) Na salts d) All of the above 	c	1	B
13	<p>8 % NaCl solution indicates the amount of NaCl in 1 litre to be</p> <ul style="list-style-type: none"> a) 8 g a) 80 g b) 0.8 c) 0.08 g 	a	1	B
14	<p>Zeolite exchanger has ability to replace Calcium ions in water by</p> <ul style="list-style-type: none"> a) Sodium ions b) Magnesium ions c) Hydrogen ions d) Hydroxyl ions 	a	1	B
15	<p>Zeolite is regenerated by washing the bed with solution of</p> <ul style="list-style-type: none"> a) NaCl b) $MgCl_2$ c) HCl d) $CaCl_2$ 	a	1	B
16	<p>The exhausted zeolite bed is in the form of</p> <ul style="list-style-type: none"> a) Na_2Z b) K_2Z c) CaZ d) H_2Z 	a	1	B

17	Zeolite process removes hardness of water by a) Formation of sludge. b) Converting it into sodium impurities. c) By sedimentation. d) By degasification.	b	1	B
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18	Zeolite softener can soften water having hardness a) Less than 500 ppm b) Greater than 500ppm c) Any variation of hardness d) None of above	c	1	B
19	Zeolite softener gives water with residual hardness a) Above 50 ppm b) 0 ppm c) About 10 ppm d) None of the above	c	1	B
20	Water percolated over zeolite bed should not contain any a) Hardness b) Mineral acids c) Ca ions d) Mg ions	b	1	B
21	Granular Zeolite in packed in a tower a) Below a layer of gravels b) Mixed with gravels c) Suspended in water d) Above a layer of gravels	d	1	B
22	Water softened by zeolite softener has same amount of a) Hardness b) Mineral acids c) Total dissolved solids d) All of above	c	1	B
23	The zeolite bed can be regenerated a) Once b) Twice c) Thrice d) Several times	d	1	B
24	If water has 380ppm hardness then it has a) 38 mg of Ca salts in 1 litre b) 380 mg of Ca salts in 1 litre c) 380 mg of CaCO ₃ equivalents in 1 litre d) 38 mg of CaCO ₃ equivalents in 1 litre	c	1	B

25	Cation exchange resin has functional group a) $\square\text{SO}_3\text{H}$ b) $\square\text{NMe}_3\text{OH}$ c) $\square\text{CH}_4$ d) $\square\text{SO}_4$	a	1	B
26	Anion exchange resin has functional group e) $\square\text{SO}_3\text{H}$ f) $\square\text{NMe}_3\text{OH}$ g) $\square\text{CH}_4$ h) $\square\text{SO}_4$	b	1	B

27	Cation exchange resin is denoted as a) $\text{R}(\text{OH})_2$ b) RH_2 c) ROOH d) RCOH	b	1	B
28	Anion exchange resin is denoted as a) $\text{R}(\text{OH})_2$ b) RH_2 c) ROOH d) RCOH	a	1	B
29	The exhausted cation exchange resin is regenerated by passing as solution of a) dil. NaOH b) dil. HCl c) dil NaCl d) dil EDTA	b	1	B
30	The exhausted anion exchange resin is regenerated by passing as solution of a) dil. NaOH b) dil. HCl c) dil NaCl d) dil EDTA	a	1	B
31	when boiler water is treated with sodium aluminates, it gets hydrolyzed forming a) gelatinous aluminium hydroxide precipitate b) gelatinous sodium hydroxide precipitate c) gelatinous potassium hydroxide precipitate d) gelatinous calcium hydroxide precipitate	a	1	B

32	the process of removing salts from brackish water is a) desalination b) demineralization c) distillation d) deionization	a	1	B
33	to decrease concentration of salts in water by applying direct electric current, the process used is a) ion exchange b) zeolite c) electrodialysis d) osmosis	c	1	B
34	reverse osmosis is a process in which a) contaminants are removed from water b) water is separated from its contaminants c) hardness of water is removed d) dissolved gases from water is removed	b	1	B
35	reverse osmosis is a process which removes a) ionic and non ionic matter b) colloidal matter c) high molecular weight organic matter d) all of the above	d	1	B

36	in reverse osmosis flow of liquid is from _____ solution. a) dilute to concentrated b) concentrated to dilute c) top to bottom d) none of these	b	1	B
37	reverse osmosis is also known as a) super filtration b) hyper filtration c) pressure filtration d) molecular sieve filtration	c	1	B
38.	When boiler feed water is treated with -----, it gets hydrolyzed forming gelatinous precipitate of Aluminium hydroxide. a) Sodium carbonate b) Sodium aluminate c) Sodium phosphate d) Sodium bicarbonate	b	1	B
39.	Which of the following is not method for disinfection of water a) Chlorination b) Ozonization c) Electrodialysis d) UV treatment	c	1	B

40	Metaphosphate on hydrolysis forms a) Na_3PO_4 b) Na_2HPO_4 c) NaH_2PO_4 d) None of these	b	1	B
41	Pyrophosphate on hydrolysis forms a) Na_3PO_4 b) Na_2HPO_4 c) NaH_2PO_4 d) None of these	C	1	B
42	Temporary hardness in water is removed by a) crystallization b) filtration c) addition of Na_2CO_3 d) boiling	b	1	B
43	Permanent hardness in water is caused by a) MgCO_3 b) CaCO_3 c) CaSO_4 d) $\text{Mg}(\text{HCO}_3)_2$	c	1	B

44	In softening of water by zeolites which of the following statement is most appropriate a) hardness of water is removed b) all cations & anions are removed from water c) all anions are removed from water d) soft water is obtained but treated water contains equivalent quantities of sodium salts	d	1	B
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45	For the softening of hard water by zeolite a) quantity of hardness causing salts in water should be accurately known b) quantity of hardness causing salts in water need not be known c) total dissolved solids in water should be known d) hard water should be sterilized before treatment	b	1	B
46	For the regeneration of zeolite bed a) quantity and hardness of water percolated should be known b) quantity of hardness in water need not be known c) total dissolved solids in water should be known d) hard water should be sterilized before treatment	a	1	B
47	The exhausted resins in the ion exchange process are regenerated by a) cation exchanger by 10 % NaCl & anion exchanger by dil NaOH b) cation exchanger by dil HCl & anion exchanger by 10% NaCl c) cation exchanger by dil NaOH & anion exchanger by dil HCl d) cation exchanger by dil HCl & anion exchanger by dil NaOH	d	1	B
48	The method of water treatment by which distilled water quality output water is obtained is a) zeolite method b) cation anion exchange resin method c) lime soda method d) sodium phosphate method	b	1	B
49	Hardness of water is accurately determined by titration against a) std. AgNO ₃ solution b) std EDTA solution c) std. KMnO ₄ solution d) std H ₂ SO ₄ solution	b	1	B
50	Scale formation in boiler causes the problem of a) wastage of heat b) over heating of boiler c) bursting of boiler d) all of these	a	1	B

51	Which of the methods separate both ionic and nonionic impurities a) reverse osmosis b) electrodialysis c) zeolite process d) ions exchange process	a	1	B
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52	<p>_____ type of water is obtained when Reverse osmosis is carried out with a semi permeable membrane having limited ion permeability</p> <p>a) drinking water b) water for industrial use c) distilled quality water d) salty taste water</p>	a	1	B
53	<p>The process of removing extra salts from sea water is called as</p> <p>a) softening b) deionization c) de salination d) electrodialysis</p>	c	1	B
54	<p>RO process involves</p> <p>a) solvent moves from solution of higher conc. to lower conc. through semipermeable membrane</p> <p>b) solute molecules move from solution of higher conc. to lower conc. through semipermeable membrane</p> <p>c) solvent moves from lower conc. to higher conc.</p> <p>d) solute molecules move from solution of lower conc to solution of higher conc. through semipermeable membrane</p>	a	1	B
55	<p>A semipermeable membrane allows the flow of</p> <p>a) solute molecules b) solvent molecules c) both solute & solvent molecules d) neither solute nor solvent molecules</p>	b	1	B
56	<p>Which of the following does not form scale</p> <p>a) CaSO_4 b) MgSO_4 c) CaCO_3 d) $\text{Mg}(\text{OH})_2$</p>	b	1	B
57	<p>Internal treatment of boiler feed water involves</p> <p>a) conversion of scale to loose precipitate b) conversion of scale to soluble substances c) cracking down the scale to powder d) both a & b</p>	d	1	B

58	<p>Flow of water through semi permeable membrane from higher concentration to lower concentration takes place when</p> <p>a) applied pressure < osmotic pressure</p> <p>b) applied pressure = osmotic pressure</p> <p>c) applied pressure > osmotic pressure</p> <p>d) applied pressure = 0</p>	c	1	B
59	<p>Sodium zeolite are capable of exchanging</p> <p>a) Al^{+3} ions b) Na^{+} ions c) Ca^{+2} ions d) Mg^{+2} ions</p>	b	1	B
60	<p>$\text{Mg}(\text{HCO}_3)_2$ on boiling forms a)</p> <p>$\text{MgCO}_3 + \text{CO}_2 + \text{H}_2\text{O}$</p> <p>b) $\text{MgCO}_3 + \text{CO}_2$</p> <p>c) $\text{Mg}(\text{OH})_2 + 2\text{CO}_2$</p> <p>d) $\text{Mg}(\text{OH})_2 + \text{H}_2\text{CO}_3$</p>	c	1	B