FEDERAL PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION FOR RECRUITMENT TO POSTS IN PBS-17 UNDER THE FEDERAL GOVERNMENT, 2002

CHEMISTRY, PAPER-I

(24)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE: Attempt **FIVE** questions in all, including **QUESTION NO. 8** which is **COMPULSORY**. All questions carry **EQUAL** marks.

			Marks
1	(a)	Describe briefl / open, isolated and closed systems	07
	(b)	Calculate the work done when 6 moles of hydrogen expand isothermally and reversibly at 30°C from 1 to 0.1 atmospheric pressure. R= 8.31 J K^{-1} $mole^{-1}$	05
	(c)	What is Kirchhoff's equation?	03
	(d)	Calculate the efficiency of a steam engine working between a hot reservoir at 130°C and a cold reservoir at 45°C	05
2	(a)	The passage of current for one hour through a dilute solution of sodium hydroxide with platinum electrode liberates 600 ml of mixed hydrogen and oxygen at STP. Calculate the strength of the current.	05
	(b)	What is buffer action? How a buffer solution of any desired PH is prepared?	05
	(c)	What is a revereable cell? Give an example of such a cell and explain its behaviar.	05
	(d)	How would you determine the equivalent conductance of a solution of strong electrolyte.	05
3	Write NOTES on any FOUR of the followings:		
	(a)	Activated Carbon	05
	(b)	Manufacture of special glass.	05
	(c)	Portland cement and its types.	05
	(d)	Manufacture of wet-process Phosphoric Acid.	05
	(e)	Carbon Black and its uses.	05
4	(a)	What are the basic raw materials for manufacturing ordinary Portland cement and mention their sources.	05
	(b)	Write in brief the physical and chemical changes during heat treatment of ceramic wares.	06
	(c)	Write briefly about borosilicate, lead and soda lime glasses.	09
5	(a)	What is acid rain? What are its impact on plants and animals?	06
	(b)	Mention health effects of carbon monoxide and oxides of nitrogen.	06
	(c)	What are organic and inorganic pollutants? Define B.O.D., C.O.D. and T.D.S.	08
6	Write NOTES on the following:		
	(a)	Photochemical Effect. (b) Compton Effect .	5, 5
	(c)	Hydrogen Bond. (d) Schrodinger Equation.	5, 5
7	(a)	Discuss the role of Molecular Orbital and Crystal Field Theories to explain the structures of complex compounds.	08
	(b)	Explain the significance of sigma (σ) and pi (π) bonds.	06
	(c)	Discuss complex compounds and their importance.	06

COMPULSORY QUESTION

8. Write only the correct choice in the Answer Book. Don't reproduce the statement.

1	The energy associated with any quantum is proportional to the ..... Of the radiation.			
	(a)	Frequency	(b)	Speed
	(c)	Wave length	(d)	Wave number
	(e)	None of these.		
2.	According to Heisenberg's uncertainty principle the precise ..... of a specific electron in an orbit can not be determined.			
	(a)	Position	(b)	Energy
	(c)	Mass	(d)	None of these.
	tivated carbon is regenerated at the following temperatures (°C).			
	(a)	240 °C	(b)	400 °C
	(c)	650 °C	(d)	730 °C
	(e)	None of these.		

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4 95% of domestic carbon black is used in the following industry:

(a) Leather (b) Rubber
(c) Textile (d) Soap
(e) None of these.

5 Lead Glass contains ..... % of Lead:

(a) 20 (b) 40
(c) 60 (d) 92
(e) None of these.

6 The atmospheric air contains the following amount (in ppm):

(a) 0.6 (b) 1.5
(c) 0.1 (d) 2.5
(e) None of these.

7 Pollution strength of wastewater is determined by:

(a) C.O.D. (b) PH
(c) B.O.D. (d) D.O.
(e) None of these.

8 In secondary treatment of wastewater the dissolved and colloidal organic matters are removed by:

(a) Sedimentation (b) Catalyst
(c) Bacteria (d) None of these.

9 Bomb calorimeter is used for measuring:

(a) Heat of solution (b) Heat of Neutralization
(c) Heat of Precipitation (d) Heat of combustion.
(e) None of these.

10 Intensive Property depends on:

(a) Heat capacity (b) Enthalpy
(c) Internal Energy (d) Surface tension. (e) None of these.

11 The part of electrochemical cell at which oxidation occurs is called:

(a) Cathode (b) Anode
(c) Cation (d) Electrolyte. (e) None of these.

12 According to Ostwalds dilution law, the degree of dissociation of weak electrolytes will reach a limiting value of:

(a) Zero (b) 1
(c) -1 (d) α (e) None of these.

13 A substance which acts as an acid as well as a base in different situation is called:

(a) Amorphous (b) General
(c) Amphoteric (d) Crystalline (e) None of these.

14 α-rays are fast moving of:

(a) Hydrogen (b) Helium
(c) Neon (d) None of these.

15 There are ..... Orbitals in d sub-shell.

(a) 3 (b) 2
(c) 5 (d) 4 (e) None of these.

16 The passage of electrical current through electrolytes is always accompanied by:

(a) Cooling (b) Evolution of Hydrogen
(c) Chemical change (d) Vaporization. (e) None of these.

17 In the synthesis of Ammonia (a major raw material for nitrogenous fertilizer) the equilibrium yield is increased by:

(a) Increase of temperature (b) Decrease of temperature
(c) Increase of pressure (d) Decrease of pressure.
(e) None of these.

18 Borosilicate glass contains the following amount of silica (%):

(a) 20 (b) 40
(c) 70 (d) 82 (e) None of these.

19 The process of removing all the ions in water is:

(a) Sedimentation (b) Precipitation
(c) Distillation (d) Catalyst addition (e) None of these.

20 The process which occurs in nature on its own accord is termed as:

(a) Irreversible (b) Equilibrium
(c) Spontaneous (d) Photoelectric. (e) None of these.

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NOTE: Attempt **FIVE** questions in all, including **QUESTION NO. 8** which is **COMPULSORY**. All questions carry **EQUAL** marks

			Marks
1	(a)	What is meant by Acid-Base catalysis? Explain, giving examples, the theories of Acid-Base catalysis.	14
	(b)	Distinguish between physical adsorption and chemisorption giving suitable examples	04
	(c)	How does the change in temperature affect adsorption.	02
2	(a)	What is rate law? Discuss its significance?	04
	(b)	Derive the kinetic expression for the rate constant for a second order reaction with same initial concentrations of the reactions.	10
	(c)	How surface area of an adsorbent is determined.	06
3	(a)	Compare Valence Bond Theory with Molecular Orbital Theory.	08
	(b)	Draw the geometries of the following species on the basis of Vsepr Theory: (i) ClF_3 (ii) IF_5 (iii) SF_4 (iv) $SnCl_2$	08
	(c)	Write a short note on heterogeneous catalysis.	04
4	(a)	What do you know about nucleophilic aromatic substitution reactions. Give their synthetic applications.	08
	(b)	Comment on the limitations of friedel crafts reaction.	06
	(c)	Classify Azo dyes on the basis of their applications, give at least two examples in each case.	06
5	(a)	What are Grignard's Regents, discuss their synthetic importance.	10
	(b)	What is the difference between basicity and nucleophilicity. Arrange H_2O, $\bar{N}H_2$, OH^-, $R\bar{S}$, $C\bar{N}$ and Cl^- in their decreasing order of nucleophilicity.	06
	(c)	Discuss four major industrial uses of alkyl halides other than as synthetic reagents.	04

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6 **Write comprehensive notes on ANY TWO of the following:**

(a)	Conformational analysis	10
(b)	Polymerization	10
(c)	Alkaloids	10

7

(a)	How many chiral carbon atoms are there in a aldotetrose, give the fischer's formula and common names for the stereoisomers of an aldotetrose and classify them as D and L sugars.	02+ 04+ 02
(b)	Why do aldoses react with fehling solution but not with sodium bisulphate.	04
(c)	What is meant by lactose intolerance.	04
(d)	Give a simple test for starch, is it affected by temperature.	02+02

COMPULSORY QUESTION

8. Write only the correct choice in the Answer Book. Don't reproduce the statement.

A. Choose the suitable answer from the given options.

1	According to Vsepr Theory, the shape of SF_4 Molecule is:			
	(a)	Octahedral	(b)	Trigonal Planar
	(c)	V-Shape	(d)	Tetrahedral
	(e)	None of these.		
2	A dsp^2 Hybrid has structure as:			
	(a)	Linear	(b)	Square planner
	(c)	Square pyramidal	(d)	Octahedral
	(e)	None of these.		
3	The large increase in rate of reaction on increase in temperature is due to:			
	(a)	Lowering of activation energy	(b)	Decrease in mean free path
	(c)	Increase in collision frequency	(d)	Decrease in collision frequency
	(e)	Increase in the number of molecules having more than threshold energy.		
4	A substance that lowers the activity of a catalyst is called:			
	(a)	Autocatalyst	(b)	Negative catalyst
	(c)	Promoter	(d)	Poison
	(e)	None of these.		

10

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5	PH of a 0.1 N NaOH is:			
	(a)	1	(b)	2
	(c)	3	(d)	4
	(e)	None of these.		
6	Cholicalciferol is a:			
	(a)	Steroid	(b)	Lipid
	(c)	Fat	(d)	Vitamin
	(e)	None of these.		
7	For molecules having n centers of chirality, the number of possible stereoisomers is:			
	(a)	2^n	(b)	Less than 2^n
	(c)	More than 2^n	(d)	None of these.
8	Reactions in which there are no intermediates are referred to as:			
	(a)	Free radical reactions	(b)	Addition reactions
	(c)	Concerted reactions	(d)	None of these.
9	Adsorption theory explains:			
	(a)	Enzyme catalysis	(b)	Acid-Base catalysis
	(c)	Homogeneous catalysis	(d)	Heterogeneous catalysis
	(e)	None of these.		
10	The substance on whose surface adsorption takes place is called:			
	(a)	Adsorbate	(b)	Active surface
	(c)	Porous substance	(d)	Adsorbent
	(e)	None of these.		

B. Write only true of false in the Answer Book. Do not reproduce the statement.

11	Adsorption increases with rise in temperature.
12	The catalyst changes the position of equilibrium.
13	Order and molicularity of a reaction are always identical.
14	Hydrolysis of methylacetate is an example of a 2nd order reaction.
15	Glucose is the only sugar which mutarotates.

C. Suggest the most suitable word for each of the following statements.

16	A cyclic form of a carbohydrate that has a five membered ring.
17	Structural isomers that differ only in the position of a hydrogen and a pi bond.
18	A stabilizing interaction of a sigma molecular orbital with an empty p orbital on an adjacent atom.
19	The result of a reaction that can produce two or more structural isomers.
20	The state in which the forward rate of an ideally reversible reaction is equal to the reverse rate.

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