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3 (Sem-6/CBCS) CHE HE 1/2/3

2023

**CHEMISTRY**

(Honours Elective)

Answer the Questions from any one Option.

**OPTION - A**

*(Green Chemistry)*

Paper : CHE-HE-6016

**OPTION - B**

*(Industrial Chemicals and Environment)*

Paper : CHE-HE-6026

**OPTION - C**

*(Inorganic Materials of  
Industrial Importance)*

Paper : CHE-HE-6036

Full Marks : 60

Time : Three hours

***The figures in the margin indicate  
full marks for the questions.***

Contd.

## OPTION - A

Paper : CHE-HE-6016

### (Green Chemistry)

1. Answer the following questions :  $1 \times 7 = 7$

(a) Which of the following is not one of the twelve principles of green chemistry ?

(i) Less hazardous chemical synthesis

(ii) Maximization of atom economy

(iii) Preference to stoichiometric reagents over catalysts

(iv) Use of Renewable feedstocks

(b) Biomagnification of DDT causes decline in bird population by

(i) bringing disturbance in calcium metabolism

(ii) thinning of egg shell

(iii) premature breaking of eggs

(iv) All of the above

- (c) Which among the following is not a renewable source of energy ?
- (i) Solar energy
  - (ii) Biomass energy
  - (iii) Hydro-power
  - (iv) Geothermal energy
- (d) Which green solvent is now used by dry cleaning industry ?
- (i) Liquid carbon dioxide ( $CO_2$ )
  - (ii) Perchloroethylene (perc)
  - (iii) Carbon tetra chloride ( $CCl_4$ )
  - (iv) Dichloromethane ( $CHCl_2$ )
- (e) Catalytic reagents are superior to stoichiometric reagents. (*True/False*)
- (f) Metathesis reaction is a green chemical process. (*True/False*)
- (g) Which gas was responsible for the Bhopal Gas Tragedy ?

2. Answer the following questions :  $2 \times 4 = 8$

(a) Give *one* example of a ultrasound assisted reaction.

(b) What is ionic liquid ? Give *one* example.  $1 + 1 = 2$

(c) Why is use of CFCs forbidden in most of the advanced countries ?

(d) What do you mean by E-factor ?

3. Answer **any three** of the following questions :  $5 \times 3 = 15$

(a) What are Green Solvents ? Discuss the advantages and disadvantages of using supercritical carbon dioxide as solvents in place of organic solvents.  $2 + 3 = 5$

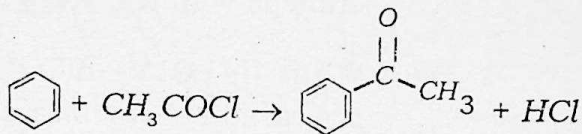
(b) What are the problems caused by chemical waste ? Explain with examples.

(c) Write the reactions involved in the green synthesis of

(i) Adipic acid

(ii) Paracetamol  $3 + 2$

- (d) Define atom economy. Calculate the per cent atom economy for the preparation of acetophenone using the following reaction



Is Diels-Alder reaction an atom economic reaction ?

$$1+3+1=5$$

- (e) What is the relationship between risk and hazard? How does green chemistry approach the problem of risk?  $2+3=5$

4. Answer **any three** of the following questions :  $10 \times 3 = 30$

(a) (i) Make a list of the 12 principles of green chemistry. 4

(ii) Explain *any three* of the 12 principles. 6

(b) What do you mean by sustainable development? How does green chemistry contribute to the world's sustainable development? State *one* principle of green chemistry and discuss its importance in our society.

$$2+4+4=10$$

- (c) (i) Mention the names of *two* reagents used for allylic and benzylic free radical bromination. Write the products formed on bromination of cumene with these reagents. 5
- (ii) What is Clayan? How is it prepared? Give *one* example of application of Clayan in organic synthesis? 5
- (d) What is green energy? How renewable energy supports in achieving goal of green chemistry? Discuss the potential of biomass as a source of renewable energy. 2+4+4=10
- (e) How do microwave promote chemical reaction? Discuss *two* advantages of microwave assisted organic synthesis. Write the reaction of saponification of ester and Diels Alder reaction under microwave irradiation. Discuss the role and limitations of solvents for carrying out a chemical reaction using this energy source. 2+2+2+4=10

(f) Give the green synthesis of the following :  
2.5×4=10

(i) BHT

(ii) Citral

(iii) Furfural

(iv) Catechol

Write only the reactions involved.

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## OPTION - B

Paper : CHE-HE-6026

### **(Industrial Chemicals and Environment)**

1. Answer the following questions :  $1 \times 7 = 7$

(a) Which of the following chemicals is used in wound treatment ?

- (i) Bleaching powder
- (ii) Caustic soda
- (iii) Hydrochloric acid
- (iv) Hydrogen peroxide

(b) Which of the following pair of gases is toxic to humans ?

- (i)  $N_2$  and  $CO_2$
- (ii)  $CO_2$  and  $CH_4$
- (iii)  $CO$  and  $COCl_2$
- (iv)  $Ar$  and  $N_2$

(c) Zone refining is a method to obtain :

- (i) Very high temperature
- (ii) Ultra-pure gases
- (iii) Ultra-pure metals
- (iv) Ultra-pure oxides



(d) The global environmental issue of ozone layer depletion is associated with

- (i) Sulphur dioxide
- (ii) Carbon dioxide
- (iii) Methane
- (iv) Chlorinated hydrocarbons

(e) Which of the following are the primary causes of water pollution ?

- (a) Plants (b) Animals
- (c) Human activities (d) None of these

Choose the most appropriate answer from the options given below :

- (i) (a) and (b) only
- (ii) (b) and (d) only
- (iii) (d) only
- (iv) (a), (b) and (c) only

(f) Which of the following is a type of non-renewable resource ?

- (i) Nuclear energy
- (ii) Solar energy
- (iii) Geothermal energy
- (iv) Hydrogen and fuel cells

(g) The most used method for measuring the dissolved oxygen content in a water sample is

- (i) Winkler method
- (ii) Roger method
- (iii) Tittler method
- (iv) Johnson method

2. Answer the following questions :  $2 \times 4 = 8$

- (a) Give *two* uses of industrial oxygen gas.
- (b) Give *one* method (with reaction) for the industrial production of concentrated hydrochloric acid.
- (c) Mention *two* major sources of air pollution.
- (d) What is nuclear fusion? Give an example.

3. Answer **any three** questions:  $5 \times 3 = 15$

- (a) Write briefly about the industrial production of fluorine gas. Mention *one* use of the gas.  $4 + 1 = 5$
- (b) Write a note on the biogeochemical cycle of nitrogen.
- (c) Write briefly about the various types of water pollutants.

- (d) Write briefly about the process of reverse osmosis for the treatment of water.
- (e) What are the sources of oxides of nitrogen in atmosphere? How these oxides deplete ozone layer? Write briefly.
- 1+4=5

4. Answer **any three** from the following questions : 10×3=30

(a) Describe the method with appropriate diagrams and reactions for the commercial production of common salt. Draw a neat diagram showing the portion of the crystal lattice of common salt. Why is common salt iodized for human consumption? Why is common salt used for de-icing of roads?

6+2+1+1=10

(b) Describe the major regions of the atmosphere by covering their temperature variations.

(c) Describe briefly the hydrological cycle. Why the "Ganga-Brahmaputra-Meghna" river system is called the largest resource of water in India? Mention *three* initiatives taken by the Government of India for the rejuvenation of Ganga.

5+2+3=10

(d) (i) What is nuclear fission? Describe this process by taking  ${}^{235}_{92}\text{U}$  as an example. Give suitable diagram showing the chain reaction.

1+4=5

(ii) What is nuclear pollution? Describe briefly about the management of nuclear disaster.

1+4=5

(e) What is green chemistry? Describe the principles of green chemistry. Why is a greener chemical reaction more desirable than a conventional chemical reaction?

1+8+1=10

(f) What is chemical oxygen demand (COD) and how does it differ from biological oxygen demand (BOD)? Describe the laboratory methods for the determination of COD and BOD. Give a source of common interference in the determination of COD.

2+7+1=10

## OPTION - C

Paper : CHE-HE-6036

### **(Inorganic Materials of Industrial Importance)**

1. Answer the following questions : 1×7=7
- (a) Urea is a source of
- (i) Nitrogen
  - (ii) Phosphorus
  - (iii) Nitrogen and Phosphorus
  - (iv) None of above
- (b) Bronze is an alloy of
- (i) Cu-Zn
  - (ii) Cu-Sn
  - (iii) Cu-Au
  - (iv) Cu-Ag
- (c) The most common inorganic pigment used in paint is
- (i)  $Al_2O_3$
  - (ii)  $TiO_2$
  - (iii)  $MgO_2$
  - (iv) CaO

(d) Non-rechargeable battery among the following is :

- (i) Laclanche cell
- (ii) Fuel cell
- (iii) Lead storage battery
- (iv) Polymer cell

(e) In Haber's process the catalyst promoter used is

- (i) *Pb*
- (ii) *Mo*
- (iii) *Zn*
- (iv) *Sn*

(f) Glass is

- (i) a crystalline solid
- (ii) a supercooled liquid
- (iii) an amorphous solid
- (iv) All of above

(g) The resins present in glass paint is

- (i) Alkyd resins
- (ii) Acrylic polymer resin
- (iii) Epoxy resin

2. Answer the following :  $2 \times 4 = 8$

- (i) What are straight and complex fertilizers? Give examples.
- (ii) Differentiate between wet and dry process for the manufacture of cement.
- (iii) How will you differentiate silicate glass from non-silicate glass?
- (iv) Differentiate between homogeneous and heterogeneous catalyst.

3. Answer the following : **(any three)**  $5 \times 3 = 15$

- (i) What are paints? Write the requisites of a good paint.  $2 + 3 = 5$
- (ii) What do you mean by rocket propellants? Discuss on different types of rocket propellants.  $2 + 3 = 5$
- (iii) Elucidate the functioning of lithium ion battery including the reactions involved.
- (iv) Discuss on the manufacture of Urea.
- (v) What do you mean by solid state battery? What are the advantages of solid state battery over lithium ion battery?  $2 + 3 = 5$

4. Answer the following : **(any three)**  $10 \times 3 = 30$

(i) What are fertilizers ? Discuss about different types of nitrogenous fertilizers with examples.  $2+8=10$

(ii) What is battery ? Differentiate between primary and secondary batteries. Explain the working of fuel cell including reactions involved.  $1+4+5=10$

(iii) Define glass. Write the characteristics of glass. Discuss the steps involved in the manufacture of glass.  $2+3+5=10$

(iv) What is surface coating ? What are the objectives of surface coating ? Discuss the classification of surface coating.  $2+3+5=10$

(v) Discuss on metal spraying and anodizing.  $5+5=10$

(vi) Write short notes on : **(any two)**  $5+5=10$

(a) Potassic fertilizer

(b) Superconducting oxides

(c) RDX

(d) CAN