

Total Pages—5

(Set-R)

**B.Tech.-4th (Chem Engg)**  
**Fuel and Combustion**

*Full Marks : 70*

*Time : 3 hours*

**Answer all questions**

*The figures in the right-hand margin indicate marks*

*Symbols carry usual meaning*

1. Answer *all* questions : 2 × 10

(a) Define "Petrology"

(b) Arrange the petroleum distillate products according to their boiling range in ascending order.

(i) Gas oil

(ii) Kerosene

(iii) Naptha

(iv) Light Gasoline

(v) Heavy Gasoline

(vi) Residue

( Turn Over )

( 2 )

- (c) What is diesel index ?
  - (d) Define oil shales.
  - (e) Write significance of Proximate analysis.
  - (f) Write significance of Ultimate analysis.
  - (g) Give 4 examples of manufactured gases ?
  - (h) What is "Wood gas" ?
  - (i) Write advantages of gaseous fuels.
  - (j) What is ASTM ?
2. Explain in detail. What are the physical and chemical changes occurred when a pulverized coal sample is heated at various temperatures in presence of air ? 10

Or

Explain the formation and characteristic properties of (i) Peat, (ii) Lignite or Brown coal, (iii) Anthracite. 4 + 4 + 2

( 3 )

3. What is reforming process? Give a brief description about (i) Thermal reforming (ii) Catalytic reforming and (iii) Plat reforming. 1 + 3 + 3 + 3

Or

Write short notes on the following conversion processes which are employed in crude oil refining for converting lighter gases to gasoline.

- (i) Polymerization
- (ii) Alkylation
- (iii) Isomerization
- (iv) Absorption process. 3 + 3 + 3 + 1

4. Answer the following : 4 + 2 + 4

- (i) How coal gas is formed? Write the chemical characteristics of Coal gas.
- (ii) State the differences between coal gas and coke oven gas.
- (iii) Explain the detailed process for the formation of Producer gas with neat diagram.

( 4 )

Or

Give brief explanation on the formation process of Blue water gas (BWG) and Carbureted water gas (CWG). 5 + 5

5. A fuel has the following percent analysis by weight :

C : 82, H<sub>2</sub> : 10, S : 3, O<sub>2</sub> : 2.5, Ash : 2.5

For an air fuel ratio of 12 : 1, calculate

- (a) the mixture strength as a percentage rich or lean, and
- (b) the volumetric analysis of the dry products of combustion.

Air contains 23 percent O<sub>2</sub> by weight. 5 + 5

Or

A fuel has the following percentage volumetric analysis :

H<sub>2</sub> : 48, CH<sub>4</sub> : 26, CO<sub>2</sub> : 11, CO : 5, N<sub>2</sub> : 10

The percentage volumetric analysis of the dry exhaust gases is

CO<sub>2</sub> : 8.8, O<sub>2</sub> : 5.5, N<sub>2</sub> : 85.7

Determine the air/fuel ratio by volume if air contains 21% O<sub>2</sub> by volume. 10

( 5 )

6. Calculate the minimum volume of air required (i) on weight basis, (ii) on mole basis, to burn 1kg of coal having the following composition by weight.

C : 72.4%, H<sub>2</sub> : 5.3%, N<sub>2</sub> : 1.8%, O<sub>2</sub> : 8.5%,  
moisture : 7.2%, S : 0.9% and ash : 3.9%. 5 + 5

Or

The composition of dry flue gases obtained by burning a liquid fuel containing only hydrogen and carbon is

CO<sub>2</sub> : 10.7%, O<sub>2</sub> : 5.1%, N<sub>2</sub> : 84.2%  
Calculate the composition of the fuel by weight and excess air used. 10