VKR/KS/13/6445

Faculty of Engineering & Technology
Second Semester B.E. Examination
MATERIALS CHEMISTRY

Time—Two Hours] [Maximum Marks—40

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Solve **FOUR** questions as follows :
Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.

(3) Due credit will be given to neatness and adequate dimensions.

(4) Assume suitable data wherever necessary.

(5) Diagrams and Chemical equations should be given wherever necessary.

(6) Illustrate your answers wherever necessary with the help of neat sketches.

(7) Discuss the reaction, mechanism wherever necessary.

(8) Use of non-programmable calculator is permitted.

1. (A) During determination of calorific value of a coal sample by Bomb's calorimeter following results were recorded :
Weight of fuel burnt = 1.90 gm
Water equivalent of calorimeter = 500 gm
Weight of water taken in calorimeter = 2300 gm
Initial temperature of water = 25.05°C

Final temperature of water = 29.23°C

Acid correction = 15 cal.

Fuse wire correction = 7 cal.

Thread correction = 5 cal.

Cooling correction = 0.26°C.

If the fuel contains 7.5% Hydrogen, calculate the gross and net calorific value of the coal sample provided that the latent heat of steam condensed is 587 cal/gm. 4

(B) Write short notes on (any **TWO**) :

(i) Significance of ultimate analysis of coal

(ii) Biodiesel

(iii) Non-conventional sources of energy. 6

OR

2. (A) What are the significance of proximate analysis of coal ? 3

(B) What are rocket propellants ? Explain the classification of propellants. 3

(C) Explain how calorific value of a gaseous fuel is determined by using Boy's calorimeter. 4

3. (A) A coal sample has following percentage composition by mass :

C = 74%, H = 6.8%, O = 13.2%, N_2 = 2.1%, S = 1% and rest is ash.

Calculate :

(i) Minimum volume of air in m^3 at NTP required for complete combustion of 100 kg of the fuel.

(ii) Volumetric composition of dry products if 40% excess air is supplied. 4+4

(B) Explain Fischer Tropsch Process for manufacturing of synthetic gasoline with a well labelled diagram. 4

OR

4. (A) What is cracking ? Explain the process of fluid bed catalytic cracking of heavy oil. 6

(B) Explain the process of fractional distillation of crude oil with a well labelled diagram. What are the different fractions of petroleum and their uses ? 6

5. (A) What are semi-solid lubricants ? State the conditions under which they are used. 3

(B) Write short notes on (any **TWO**) :

(i) Boundary lubrication

(ii) Silicones

(iii) Cloud and pour point. 5

OR

6. (A) Explain extreme pressure lubrication. 3

(B) A lubricating oil has same viscosity as that of standard naphthenic and paraffinic base oil at 210°F. Their viscosities at 100°F are 350 sec., 460 sec. and 280 sec. respectively. Find the viscosity index of the oil. 2

(C) Write the criteria for selection of lubricants for :

(i) IC engine

(ii) Transformer

(iii) Steam turbine. 3

7. (A) What are the properties and applications of Liquid Crystal Polymers ? Discuss different phases of LCP. 4

(B) Define carbon nanotubes. List any two applications of carbon nanotubes. 3

(C) Discuss applications of nanomaterials in environmental fields. 3

OR

8. (A) What are biodegradable polymers ? Give synthesis and applications of poly lactic acid. 3

(B) What are composite materials ? Give industrial applications of fibre reinforced composite materials. 3

(C) What are conducting polymers ? Give the properties and applications of polyaniline. 4