Total No. of printed pages = 6

CY 131203

Roll No. of candidate | | | | | | | | | |

2017

B. Tech 2nd Semester Mid Term Examination

CHEMISTRY - II

Full Marks–100 Pass Marks–35 Time–Three hours

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

1. Answer any *ten* questions : 3×10=30

(i) What do you understand by '*Anisotropic*' and '*Isotropic*' behaviour of solids ? What are the major binding forces in 'Molecular solids' and 'Ionic solids' 2+1=3

(ii) Chromium has monoatomic body centred cubic structure. Its cell edge is 300 pm. What is its density ?
(Molar mass of Cr = 52 $gmol^{-1}$, N = 6.023 $\times 10^{23}$ mol) 3

(iii) Calculate the percentage of total space occupied by the particles in simple cubic unit cell. 3

[Turn over

(iv) What are '*Thermotropic*' and '*Lyotropic*' liquid crystals ? What are the different types of Thermotropic liquid crystals ? 2+1=3

(v) On the basis of 'band theory', how will you distinguish a *conductor*, a *semiconductor* and an *insulator* ? 3

(vi) Draw the structure of : 1+1+1=3

(a) *Isotactic*

(b) *Syndiotactic* and

(c) *Atactic* polymer.

(vii) Write three differences between *Thermo-plastic* and *Thermosetting* plastics. 3

(viii) What is meant by '*doping*' ? Doping germanium with phosphorous produces *n-type* semiconductor. Explain. 1+2=3

(ix) 'The selection of a refractory for a furnace lining has to be chosen on the basis of its chemical nature.' Explain with examples. 3

(x) What are the different types of Portland cement ? Write their general composition. 1+2=3

(xi) What is meant by lubricant ? Explain the mechanism of lubrication. 1+2=3

(xii) What are the applications of solar energy ? 3

2. Answer any *ten* of the following questions : 4×10=40

(i) Convert the following Weiss indices to Miller indices : 2+2=4

(3, 6, 3), (2, 2, 2), (–2, 3, –3) and (1, 2, ∞).

Moreover, sketch (100), (110), (111) and (010) planes for a cubic crystal.

(ii) Calculate the distance between (100) planes of a crystal which exhibits '*first order*' reflection at an angle of incidence equal to 30° with X-rays of wavelength 2 Å. 4

(iii) What is 'Limiting Radius Ratio' ? Show that the radius ratio for coordination number 3 is 0.155. 1+3=4

(iv) Write brief notes on the application of liquid crystals in

(a) Thermometers and

(b) Liquid crystal display. 2+2=4

(v) What are 'F' centres ? How are they produced in an ionic crystal like ZnO ? 1+3=4

(vi) Write structural units and two important applications of each of the following :

(a) PMMA

(b) Nylon 6,6

(c) PVC and

(d) PTFE 1×4=4

(vii) Give the mechanism of addition polymerization. 4

(viii) How does reforming increase octane number ? Write two reforming reactions. 2+2=4

(ix) How is a composite defined ? Give a broad classification of composite materials. 1+3=4

(x) What is meant by calorific value of a fuel ? What are the corrections to be made in the calorific value of a fuel, determined by Bomb calorimeter ? 1+3=4

(xi) What is catalytic cracking ? What are the advantages of catalytic cracking over thermal cracking ? 1+3=4

(xii) What is meant by the term 'Nanotechnology'? Write two uses of nanotechnology in catalysis and medicine. 2+2=4

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

(i) (a) Define Lattice energy. Deduce Born Lande equation for calculation of lattice energy of an ionic crystal. 1+4=5

(b) Derive Bragg's equation for diffraction of X-rays by crystals. 5

(ii) (a) Calculate the higher and lower calorific values of a coal sample containing 84% carbon, 1.5% sulphur, 0.6% nitrogen, 5.5% hydrogen and 8.4% oxygen. 5

(b) What do you mean by the term 'Functionality' ? What are the minimum criteria for a simple organic molecule to act as a monomer ? Find the functionality of :

CH_3COOH (acetic acid), $HOCH_2CH_2OH$ (ethylene glycol) and $CH_2= CH_2$. 1+1+3=5

(iii) What is meant by knocking ? How is it related to chemical constitution ? Describe the function of TEL. Explain octane number and cetane number. 2+2+2+4=10

(iv) (a) What do you mean by 'imperfection' in ionic crystal ? Write a note on different types of imperfections in ionic crystal. 1+4=5

(b) A sample of coal was analysed as follows :

Exactly 2.500g was weighed in a silica crucible. After heating 1 hour at 110°C, the residue weighed 2.415g. The crucible was then covered with a vented lid and strongly heated for exactly 7 minutes at 950° ± 20°C. The residue weighed 1.528g. The crucible was then heated without the cover, until a constant weight is obtained. The last residue was found to weigh 0.245g. Calculate the percentage results of the above analysis. 5

(v) (a) What is number average molecular mass and weight average molecular mass of polymers ? Find the $\bar{M}_w$ for polypropylene. Given that its degree of polymerization is 10000. 3+2=5

(b) Define refractoriness. Explain the pyrometric constant for the determination of refractoriness of a refractory specimen. 2+3=5