THE OPEN UNIVERSITY OF SRI LANKA
B.Sc/ B.Ed DEGREE PROGRAMME- 2008/2009
Level 5- CHU 3237/ CHE 5237

INDUSTRIAL CHEMISTRY

ASSIGNMENT I TEST (NBT)

Date: 5th February 2009 Time: 4.00- 5.30 p.m.

Answer all the questions.

1. (a) The mineral sands are generally found in areas on or closer to the beaches in sand dunes. Sri Lanka has one of the richest mineral sand deposits in the world.
   (i) What do you mean by the term 'mineral sands'?
   (ii) Indicating the location, name three main mineral sands found in Sri Lanka. (40 marks)

   (b) The principal source of phosphorus compounds is phosphate rock- a complex material containing the mineral fluorapatite, [3 $Ca_3(PO_4)_2$. CaF_2].
   (i) Using balanced chemical equations show how phosphoric acid, normal super phosphate and triple super phosphate can be produced from fluorapatite.
   (ii) What serious environmental problem(s) are encountered in the use of phosphate rock? (40 marks)

   (c) Write essential chemical equations for the following reactions that take place in a blast furnace
   (i) reduction of iron oxide
   (ii) slag formation (20 marks)

2. (a) In the Ellingham diagram, the Free change ΔG_f° per mole O is plotted against temperature T. The free energy changes all follow a straight line.
   (i) Write down the essential features of Ellingham diagram.
   (ii) Write advantage(s) of Ellingham diagram. (20 marks)

   (b)(i) Write two examples of products manufactured in each of the industries based on latex and dry rubber.
   (ii) Briefly describe the environmental problems associated with latex based industries. (30 marks)

(c) Write down the raw materials used in ceramic industry. Briefly explain the function of each raw material in a ceramic body. (25 marks)

(d) One of the most important factors that affect the final ceramic article is the particle size distribution of raw materials.
(i) How is powder preparation done in a modern ceramic factory?
(ii) Once size reduction of raw material is done, how is size separation achieved? (25 marks)

3. (a) Titanium dioxide is one of the common chemicals used in glazing ceramic product.
(i) What do you mean by a 'glaze'?
(ii) Write advantages of using glaze on a ceramic article.
(iii) What is the difference between transparent glaze and matt glaze?
(iv) What role is played by TiO_2 in a glaze?
(v) Give the reasons as to why transition metal oxides are widely used as glazes in ceramic industry. (55 marks)

(b) For what purpose do we use the following processes in ceramic industry?
Powder pressing.....
Drain casting .....
Biscuit firing ..... (15 marks)

(c) Boron nitride is a new ceramic. It is also known as inorganic graphite.

(i) What is the main difference between a new ceramic and a traditional ceramic?
(ii) Draw the layered hexagonal structure of boron nitride.
(iii) What type of bonding is present in Boron nitride? (30 marks)

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ANSWER GUIDE FOR ASSIGNMENT TEST 1
2008/2009.

(1)(a) (i) Mineral sands

They are partials in the range 50-200 microns with high industrial and economic values.

(ii) Ilmenite,
Rutile
Zircon
Garnet,
Sillimanite,
} All from Pulmuddai

Manazite - from Pulmuddai and Beruwala

(b)(i) Normal Super phosphate

$$3[Ca_3(PO_4)_2.CaF_2] + 7H_2SO_4 + 3H_2O \longrightarrow 3[Ca(H_2PO_4)_2.H_2O] + 7CaSO_4 + 2HF$$

Triple Super phosphate.

$$3[Ca_3(PO_4)_2.CaF_2] + 14\ H_3PO_4 + 10\ H_2O \longrightarrow 10[Ca(H_2PO_4)_2.H_2O] + 2HF$$

(ii)

- If neutralized with lime before discharging that too leads to build up of solid waste.
- HF can pollute water ways.

(c) (i) $3Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2$

$Fe_3O_4 + CO \longrightarrow 3FeO + CO_2$

$FeO + CO \longrightarrow Fe_{(S)} + CO_2$

(ii) $CaO + SiO_2 \longrightarrow CaSiO_{3\,(l)}$

(2)(a)(i)

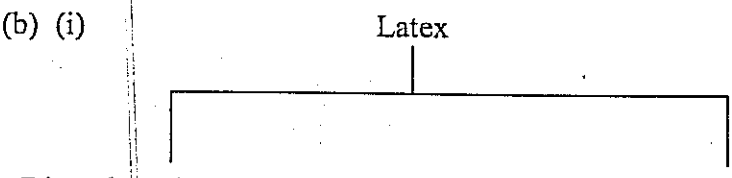
1) The graph for metal oxide all shape upwards.
2) The free energy changes, all follow a straight line unless the materials melt or vaporize.
3) When the temperature is raised, reach a point where the graph crosses the $\Delta G = 0$ line.

(ii) To predict weather

(a) C (coke) can be used to reduce metal oxide or the temperature at which it occurs

(b) A metal can be used to reduce the oxide of another metal.

(b) (i)



Dipped products
Balloons
Elastic thread

Foam products
Cushions
Carpet backing
Rubberized codes
Baby teets.

Dry rubber
Tyre rethreading
Garden hoses
Sleeves for rubber bands
Rubber
Solid rubber sheets
Automobile spare parts
Footwear

(ii) Natural rubber serum left after precipitation of rubber, has high COD and BOD which is a major pollutant to water ways.

(c) Clay- Plasticity/ ability to mould in to shape.
Silica- hardness/ strength
Fluxes- fusion of raw materials

(d)(i) By using mechanical reduction method
Eg: Crushing
Grinding
Shredding
Hibbing

(ii) There are two methods.
(i) Sieving
(ii) Cyclone separation

(3)(a) (i) Glaze is an adherent layer of glassy substance on the surface of a ceramic body.

(ii)

- It deals the surface making it non-porous
- It improves the finish malt.
- It gives a glossy finish to the article.
- Colours can be introduced to the articles.
- It gives/ adds beauty to the ceramic body.

(iii) -

(iv)

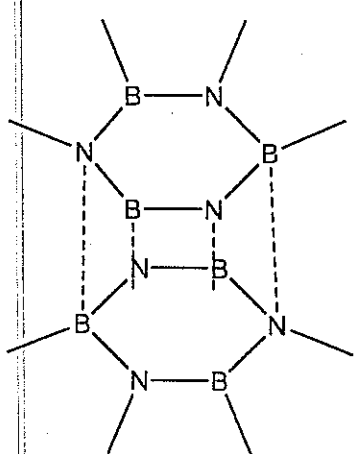
Transparent glaze	Matt glaze
(1)It has an even surface (2)Incident light will be reflected from the surface of the glaze without any distortion and there is different reflection from the surface of the object .	(1) It has an uneven surface (2) Light is reflected in all directions.

(v) A variety of colours can be introduced to an article.
Eg: Co- Deep blue
Mn- Purple
Fe- Yellow, Brown, Black

(b) Power pressing- Shaping (tiles)
Drain casting- Shaping (vase)
Biscuit firing- The tiny platelets of wood melt and fire together to give a durable product

(C)(i) Traditional ceramics are based on silicates whereas new ceramics are based on different types of other chemicals.

(ii)



(iii) Covalent bonds, Van der Waals