Please, Answer all the following Questions:-

Q1-a) Describe the ionic bonding between *magnesium (Mg)* Z= 12 and *chlorine (Cl)* Z=17 , and determine the **valance electronic**. [3]

-*b)* Define the following:-
   - *Electronegativity*   - *Quantum numbers*   - *Van der Waals bond* [3]

Q2-a) Determine the Miller indices for the directions shown in **Fig. (1)** [3]

-*b)* Determine the Miller indices for the planes shown in **Fig. (2)** [3]

-*c)* An **X-ray** film with a **50 mm** radius is used in an **X-ray** camera. A diffracted line **40 mm** from the exit port of beam is produced. Determine the interplanar spacing of the plane that produced the diffracted line if copper radiation ($\lambda = 1.5418$ Å) is used. [8]

Q3-a) Define the following:-
   - *Frenkel defect.* - *Interstitial defect.* – *Schottkly defect.* – *Vacancy.* – *Dislocation.* [5]

-*b)* **Figure (3)** shows the initial portion of the stress-strain curves for a titanium alloy at three temperatures. **(a)** Calculate the modulus of elasticity at each temperature. **(b)** Calculate the **0.2%** offset yield strength at each temperature. **(c)** Suppose a **250 mm.** long specimen with a **25 mm.** diameter is subjected to a load of **17500 Kg.** Calculate the final length of the specimen at each temperature *(assuming that dimensional changes are due only to elastic deformation).* [8]

Q4-a) A Brinell hardness test using a **3000 Kg** load with a **10 mm** diameter indentor produces a **4.1 mm** impression on steel. Calculate the Brinell hardness number and estimate the tensile strength and endurance limit of the steel. [2]

-*b)* What effect of the temperature and crystal structure upon the absorbed energy in Impact test? [2]

-*c)* What is **Larson-Miller parameter**? [3]
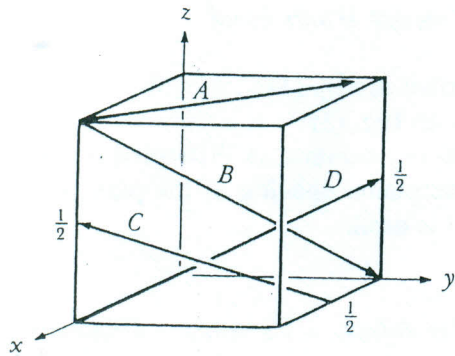

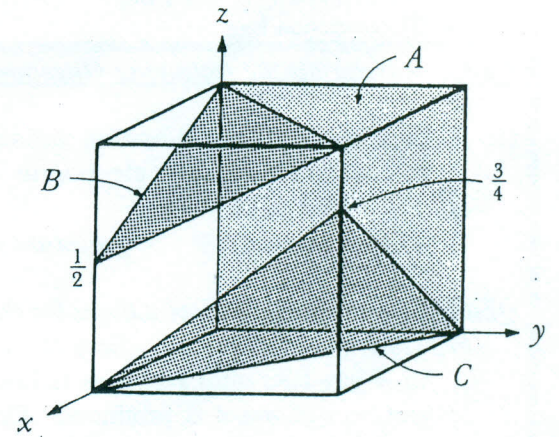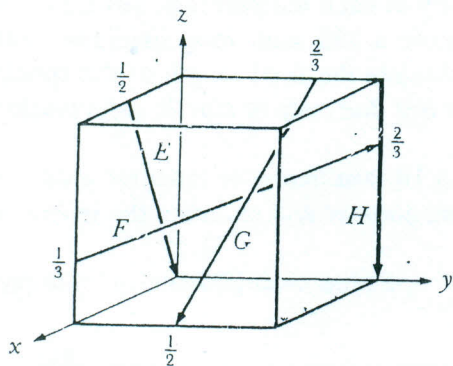*GOOD LUCK*   *Prof. Dr Eng. magdy SAMUEL*
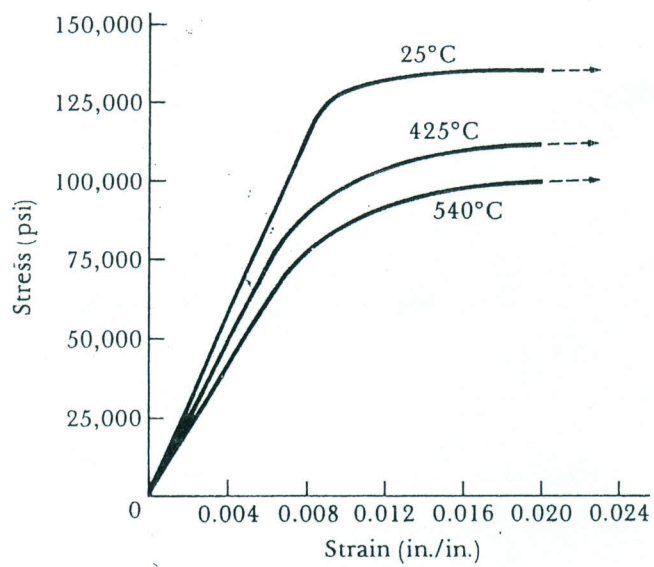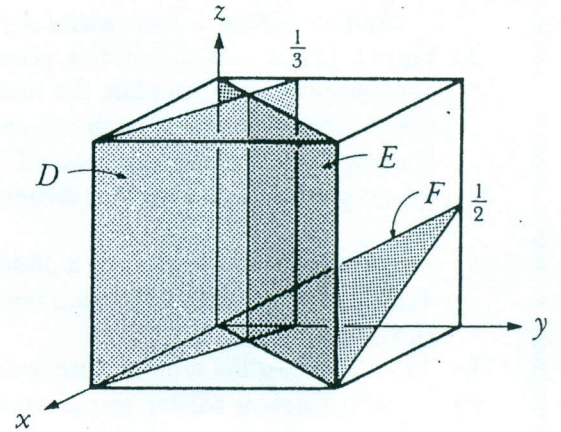
FIG. 1

FIG. 2

FIG. 3

All the Question are
Required To be answered.
Time: 2 hours

Production Eng. &Mech.Design Dept.
First year students.
Engineering Materials I
Final Exam, Jan.2014

1-Choose the correct sentence and state why?
a –Magnetite, Dolomite & Silica are considered as an Iron ore.

b –Pig Iron or plane carbon steel may have the following composition;
0.1 % C , 0.5 % Si , 0.5 % Mn , 0.03 P and 0.03 S .

c – The removal of S is easier in the Blast furnace because it has: a reducing -
Oxidizing atmosphere?

d - Silica Bricks or Alumina Bricks are used for Bessemer converters.

e – The solubility of gases in molten steel is higher or lower as the temperature
Increases?

2-Draw a neat flow sheet for a direct reduction plant.

3 - Write shortly on each of the following:
a – The efficiency of the blast furnace.
b – Three different methods for steel degasing.

4- Illustrate the Zones of reactions in a blast furnace.

5 – Draw a figure to show the relation between temperature gradient and
Variations in gas analysis with distance from tuyeres in a blast furnace.

6 – We have in Egypt two different integrated steel plants write briefly on each
Of them to illustrate the differences between them.

مع التوفيق ،،،،،
ا.د.السيد عبد الرسول
أ. د . حبيب محمود مكط ى

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