國立雲林科技大學
100學年度碩士班暨碩士在職專班招生考試試題

系所：化材系
科目：材料科學導論(1)

1、Tabulated below are data that were gathered from a series of Charpy impact tests on a ductile cast iron:

Temperature (℃)	Impact Energy (J)
-25	123.8
-50	122.7
-75	115.1
-85	100.0
-100	73.2
-110	52.1
-125	26.3
-150	9.0
-175	6.1

(a) Plot the data as impact energy versus temperature (10%)

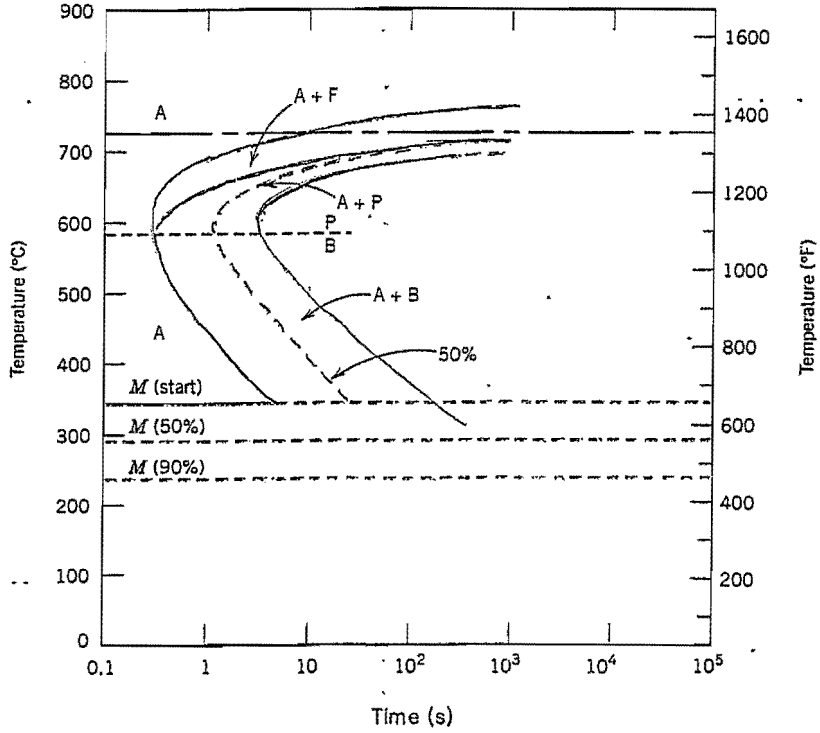
(b) Determine a ductile-to-brittle transition temperature as that temperature corresponding to the average of the maximum and minimum impact energy (10%)

2、Make a copy of the isothermal transformation diagram for a 0.46wt% C iron-carbon alloy (Figure 1), and then sketch and label on this diagram the time-temperature paths to product the following microstructures:

(a) 50% fine pearlite and 50% bainite (10%)

(b) 50% martensite and 50% austenite (10%)

Figure 1



3、List major difference between deformation by twinning and deformation by slip relative to mechanism, condition of occurrence, and final result. (10%)

4. Please pick up the right answer from the following multiple-choice questions. (20%)

i. Which of these is an object made with polymers? （A）The outside of a computer, (B) A penny, (C) An oven-proof casserole dish, (D) A piece of paper

ii. What do you call a material that is hard but brittle and is a good insulator? (A) polymer, (B) semiconductor, (C) metal, (D) ceramic

iii. Motors inside cars are mostly made out of this material? (A) polymer, (B) ceramic, (C) metal, (D) none of the above

iv. Microchips inside computers are made with silicon which is an example of a (A) polymer, (B) semiconductor, (C) metal, (D) composite

v. The outside of a modern car is made from fiberglass which is a material called a (A) polymer, (B) semiconductor, (C) ceramic, (D) composite

vi. All plastics have a certain temperature above which they are soft and pliable, and below which they are hard and brittle. This is called （A）crystallization temperature，（B）glass transition temperature，（C）polymerization temperature，（D）first order transition temperature

vii. What unit is one millionth of a millimeter? (A) a meter, (B) a micron, (C) a nanometer, (D) a centimeter

viii. The Space Shuttle is covered with special tiles which prevent it from burning up upon its return to the atmosphere. These tiles must be a (A) metal, (B) polymer, (C) semiconductor, (D) ceramic

ix. Rigid plastics tend to be strong, resist deformation, but they tend not to be very tough, that is, they're （A）brittle，（B）soft，（C）stiff，（D）flexible

x. If one measures the area underneath the stress-strain curve, the number you get is something we call（A）stiffness，（B）hardness，（C）toughness，（D）modulus

5. (a)The covalent bond between two carbon atoms, C-C, is 370 kJ/mole(88 kcal/0.6 x 10^{24} bonds) The energy of light is $E = h\nu$, where h is Planck's constant(0.66 x 10^{-33} joule sec) and ν is the frequency of light. What wavelength λ is required to break a C-C bond? (10%)

(b)What is your comment on the relationship between the calculated λ and the degradation of plastics under sunlight? (10%)

6. Compute the density of copper, which has an atomic radius of 0.128 nm, an FCC crystal structure, and an atomic weight of 63.5 g/mol. (10%)