MSE-220 – Engineering Materials

Mid-Term Exam 1- Oct,6th , 2017

Student Name: **Student Number:**

1- What are the four methods for strengthening metals and preventing failure due to dislocation? (Q23- qbank /Ch 2-Slide 32)
Ans: Alloying, cold-working, heat treatment, quenching

2- Name two NDT techniques suitable for materials subsurface flaws examination?(Book -p6)
Ans: Radiography(X-ray/gamma rays) and Ultrasonics

3- What is the main characteristic of the metalloids? (Ch 2-Slide 12)
Ans: Metalloids or semimetals – have some properties like metals (i.e. conduct electricity) but share other properties with non-metals.

4- What are dislocations and what is their role in materials? (q 17- Ass 1)
Ans:

Dislocations are lines of atomic disarray (defects) in a crystalline material that can be produced by manufacturing processes or by deformation in service. They are nature's way of accommodating deformation.

5- Which of the following is the best electrical conductor? (Cht 3-P.16)

a. Cu
b. Ag
c. Pt
e. Hg
f. Ni
g. Au

Ans: b. Ag

6- What is dispersion hardening? (Ch 2-Slide 32)
Ans: Dispersion Hardening (aka: Quench hardening) – Quenching is the rapid cooling of a workpiece in water, oil or air to obtain certain material properties.
Fine particles impede dislocation movement

7- Rate these five materials from the highest to the lowest (1 being the highest and 5 being the lowest) in terms of strength: (Slide 34-Ch2)
Iron +0.2% C annealed, Pure iron, Iron with 0.8%C quench Hardened to 50HRC, Iron+0.2%C cold work, Iron with 0.8%C annealed.
Ans: 1- Iron with 0.8%C quench Hardened to 50HRC
2- Iron with 0.8%C annealed.
3- Iron+0.2%C cold work
4- Iron +0.2% C annealed
5- Pure iron

(See back of the page)

8- Name four (out of five) stable ferromagnetic materials.(Slide 34- Ch3-pt 2)
Ans: Five of the stable ferromagnetic elements are: iron, nickel, cobalt, gadolinium, and dysprosium.

9- Between Steel, and Stainless Steel materials, which one has lower shear modulus? (Slide 47- Ch3-pt 2)
Ans: Stainless Steel

10- State three mechanical properties related to ceramics? (Slide 2- Ch3-pt 2)
Ans: Tensile/compressive properties, fracture toughness, hardness, rupture (transverse rupture)

11- State three thermal properties of the materials? (Slide 3- Ch3-pt 2)
Ans: Specific heat, Thermal expansion, Thermal conductivity

12- What is Poisson's ratio and state one application of using Poisson's ratio. (Slide 40/41- Ch3-pt 2)
Ans: Poisson's ratio is the lateral strain in a loaded shape compared with the length strain.

Figure 3–20
If a bar is pulled axially in the elastic regions, the bar will get longer and the diameter will get smaller. The ratio of these two strains, lateral: axial, is called Poisson's ratio.

13- If the modulus of elasticity of a copper alloy is 18×10^6 psi, how much would be a good estimate for its shear modulus? (Slide 47- Ch3-pt 2)
Ans: (3/8)* 18×10^6 psi= 6.75×10^6 psi

14- How can one find modulus of elasticity (E) of a material by a non destructive test? (Slide 31- Ch3-pt 2)
Ans: An ultrasonic transducer can be placed on the surface of a material, and the time that it takes for sound to travel through a material and reflect back or be received by another transducer will yield the velocity of sound in meters per second.
Then, to calculate the elastic modulus of a material, this number can be put into the standard equation, and by using this formula:
where $V = \left(\frac{E}{\rho}\right)^{1/2}$
V = velocity of sound in a material
E = modulus of elasticity
ρ= density

15- Calculate the thermal conductivity of a 40cm × 40cm aluminum plate if 100Kw of heat energy flows through it. Assume thickness of the plate to be 15.2 mm and the temperature difference across the plate being 40˚C.
Ans: Q= KA(ΔT/x)
K= [(100kW)(1000W/1kW)(15.2mm)(1cm/10mm)]/[(40cm)(40cm)(40˚C)]
K= 2.375W/cm ˚C

Good Luck. S. Behfarshad