

1. 請問熱電耦(thermocouple)需要校正之原因為何? 如何校正? (10%)
2. 一個新的半導體, 其導電度在 20°C 時為 $250\Omega^{-1}\cdot\text{m}^{-1}$, 在 100°C 時為 $1100\Omega^{-1}\cdot\text{m}^{-1}$, 試問其能隙, E_g , 為何? (10%)
3. The concentration of light-absorbing ion in solution is doubled. (10%)
 - a. How does the absorption change?
 - b. How much the thickness of the sample be altered to keep the transmission invariant?
4. Consider the compounds CoO , ZnFe_2O_4 , and $\text{Y}_3\text{Fe}_5\text{O}_{12}$. Which material would you select for each of the following applications: (10%)
 - a. A compound that must not respond to an external magnetic field.
 - b. A compound that must respond to high-frequency magnetic fields.
 - c. A compound to be used as a hard magnet.
5. 置於太空中之天文望遠鏡之結構在建構時, 其材質需考慮那些特殊性質? (10%)

6. The results of tensile strength (σ) and carbon contents (%) of a carbon steel are shown in the following table. Please (a) draw the curve (b) derive the equation of their relationship by the least square fitting method. (10%)

C%	σ	C%	σ
0.09	420	0.16	480
0.10	435	0.17	525
0.11	430	0.18	540
0.12	450	0.20	550
0.13	455	0.21	550
0.15	470	0.23	600

7. The hardness test is one of the most convenient methods for evaluating the properties of materials. Please describe briefly the measuring steps of Rockwell method for a tool steel. (10%)
8. (a) What is the definition of toughness and fracture toughness of materials respectively (b) Describe briefly the measuring methods respectively. (10%)
9. Describe (a) the possible microstructures of cast irons and (b) the major defects introduced in solidification. (10%)
10. X-ray diffraction is usually used to determine the crystal structure of materials. (a) What is the possible difference in XRD patterns obtained for samples in the types of powders and thin films of a same material? (b) How to calibrate the results of XRD? (10%)