

八十四學年度 核工所 工物所 組碩士班研究生入學考試

科目 冶金熱力學 科號 3313 共 2 頁第 1 頁 *請在試卷【答案卷】內作答

1. (20%)

Give five examples of the operation of the second law of thermodynamics in the daily experience. Elaborate as much as you can the importance of the second law of thermodynamics in these examples.

State the third law of thermodynamics and show that how it could be verified experimentally.

2. (15%)

If two closed systems are in contact to the reservoirs of two different temperatures respectively, and receiving the same amount of heat from the reservoirs, the entropy change is smaller for the system attaching to the higher temperature reservoir based on the definition of entropy. Please explain based on the statistical thermodynamics argument.

3. (15%)

If two closed systems are in contact to the reservoirs of two different temperatures respectively, and receiving the same amount of heat from the reservoirs, the entropy change is smaller for the system attaching to the higher temperature reservoir based on the definition of entropy. Please explain based on the statistical thermodynamics argument.

4. (15%)

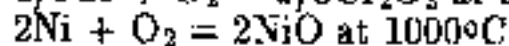
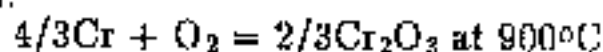
Determine the maximum pressure of water vapor in wet hydrogen at 1 atm pressure in which chromium can be heated without oxidation occurring at 1500 K. Is the oxidation of Cr by water vapor exothermic or endothermic? For



5. (15%)

Using the attached Ellingham diagram

(a) estimate the equilibrium oxygen partial pressures for the following reactions:



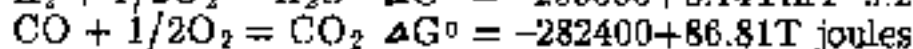
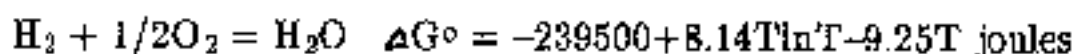
(b) decide whether aluminum-lithium alloy can be melted in an aluminum (Al_2O_3) crucible without significant reactions?

6. (20%)

If it is required to have an atmosphere containing the partial pressure of oxygen P_{O_2} of 10^{-10} atm at 2000 K, please calculate the ratio of partial pressure of H_2O to that of H_2 in the controlling water vapor / hydrogen gas mixture.

Describe the apparatus setup for the purpose stated above.

What if one wish to meet the same purpose with CO_2/CO gas mixture?



END

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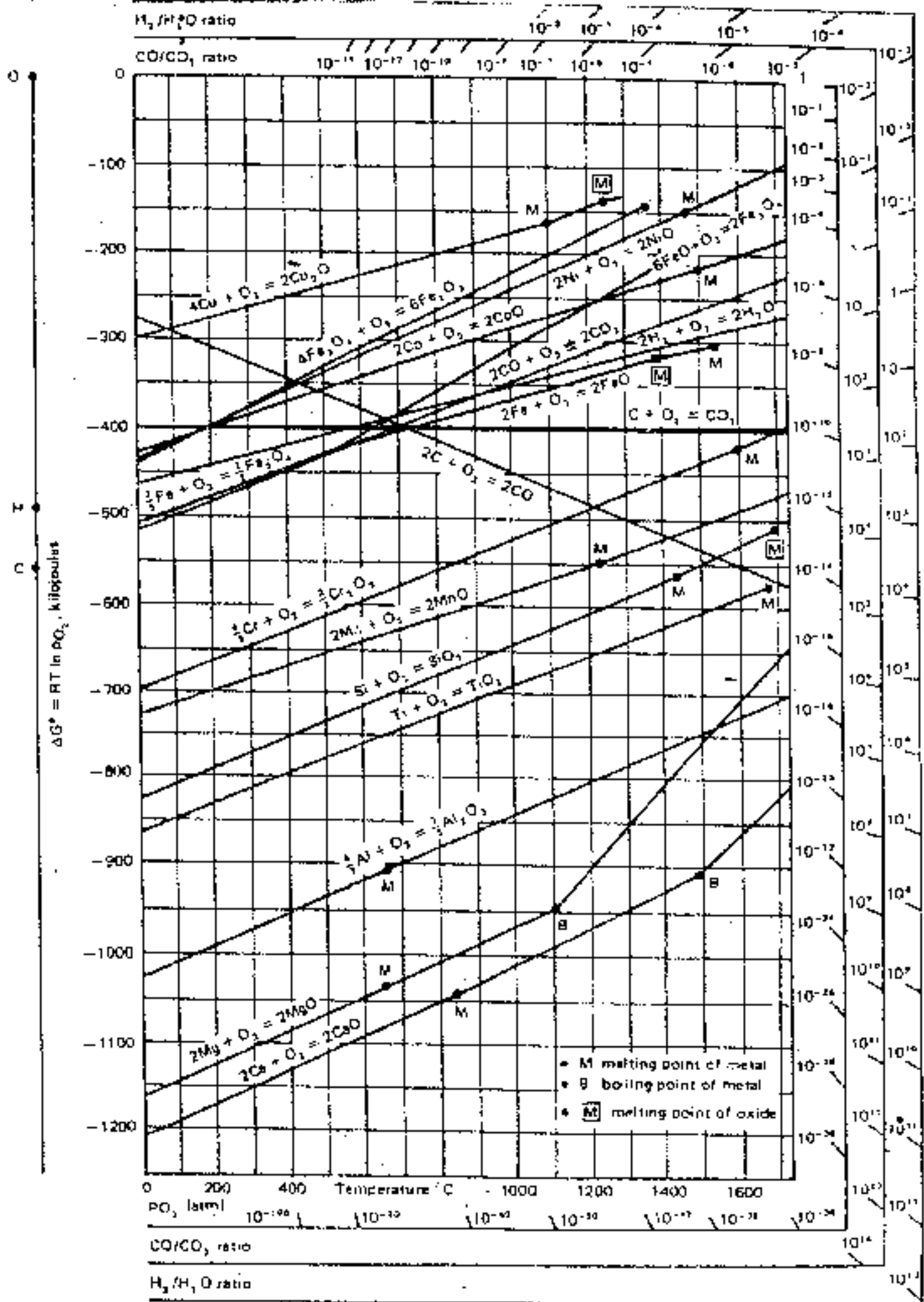


Fig. 10-13. The Ellingham diagram for metallurgically important oxides.