| Question 39 | (16 marks) |
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Pentlandite, $Fe_9Ni_9S_8$, is a common nickel sulfide ore that can be used to obtain the materials required to produce sulfuric acid. This metal sulfide ore is combusted in air to form sulfur dioxide according to the following equation.

$$\mathrm{Fe_gNi_gS_8}$$
 + 17 $\mathrm{O_2}$ \rightarrow 9 NiO + 9 FeO + 8 $\mathrm{SO_2}$

| (a) | What is the volume of sulfur dioxide produced if 2.2 tonne of pentlandite is combusted |
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| | in air? The process has a yield of 72.0%, and takes place at 300.0 °C and 165.0 kPa. |
| | Express your answer to the appropriate number of significant figures. |

| Molar mass of $Fe_9Ni_9S_8 = 1287.42 \text{ g mol}^{-1}$. | (7 marks |
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| | | | | /CI 10 | di beds of a | variauti | ин рс | IIIOXI | ide of platifier | r catalyst at |
|-------|-----------------------|---|---|--|--|---|--|---|---|---|
| | 2 SO ₂ (g) | + | O ₂ (g) | = | 2 SO ₃ (g) | | ΔΗ | = | -197.78 kJ | |
| State | two justific | atior | ns for the | e use | e of catalysts | in this p | oroces | SS. | | (2 marks) |
| One: | | | | | | | | | | |
| | | | | | | | | | | |
| Two: | | | | | | | | | | |
| | | | | | | | | | | |
| State | the effect of | of rai | sina the | pres | sure of the sy | vstem c | n bot | h the | rate and vield | d (2 marks) |
| | | | | | | 0 000 11 | | | | a. (2 manto) |
| 1 | State One: | 2 SO ₂ (g) State two justifice One: | to produce sulfur trio 2 SO ₂ (g) + State two justification One: Two: | to produce sulfur trioxide. $2 \text{ SO}_2(g) + O_2(g)$ State two justifications for the original or | to produce sulfur trioxide. $2 \text{ SO}_2(g) + \text{ O}_2(g) \rightleftharpoons$ State two justifications for the use one: Two: State the effect of raising the present the present content of the present content content of the present content of the present content con | to produce sulfur trioxide. $2 \text{ SO}_2(g) + \text{ O}_2(g) \rightleftharpoons 2 \text{ SO}_3(g)$ State two justifications for the use of catalysts One: Fivo: | to produce sulfur trioxide. $2 \text{ SO}_2(g) + \text{ O}_2(g) \rightleftharpoons 2 \text{ SO}_3(g)$ State two justifications for the use of catalysts in this point. Two: State the effect of raising the pressure of the system of the | to produce sulfur trioxide. $2 \mathrm{SO_2(g)} + \mathrm{O_2(g)} \rightleftharpoons 2 \mathrm{SO_3(g)} \qquad \Delta \mathrm{H}$ State two justifications for the use of catalysts in this process one: | to produce sulfur trioxide. $2 \mathrm{SO}_2(\mathrm{g}) \ + \ \mathrm{O}_2(\mathrm{g}) \ \rightleftharpoons \ 2 \mathrm{SO}_3(\mathrm{g}) \qquad \Delta \mathrm{H} \ = \ \mathrm{State} \ \mathbf{two} \ \mathrm{justifications} \ \mathrm{for} \ \mathrm{the} \ \mathrm{use} \ \mathrm{of} \ \mathrm{catalysts} \ \mathrm{in} \ \mathrm{this} \ \mathrm{process}.$ One: | $2 SO_{2}(g) + O_{2}(g) \rightleftharpoons 2 SO_{3}(g)$ $\Delta H = -197.78 \text{ kJ}$ |

Effect on yield:

| (d) | Use the Collision Theory to explain the effect of raising the total pressure on the yie (5 | | | | | | | |
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