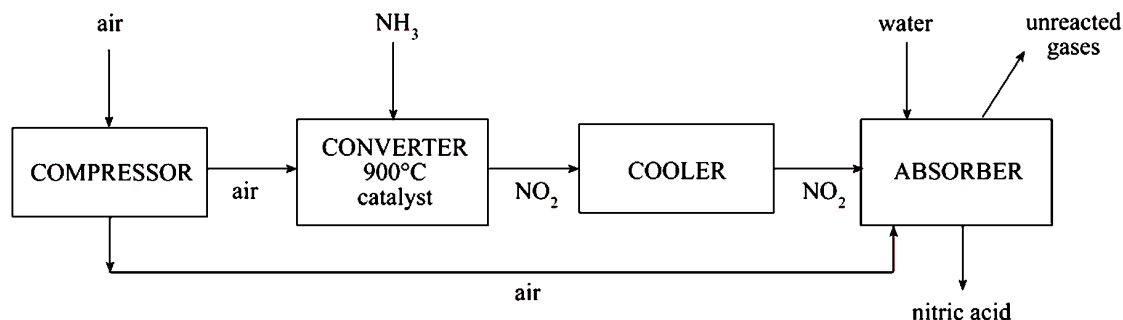


1.

The production of nitric acid in a factory is summarised in the flow chart below:



- (a) The overall reaction in the CONVERTER is exothermic. Draw an energy profile diagram for the overall reaction in the CONVERTER, clearly identifying ΔH and the activation energy. /4
- (b) Explain why the gases in the CONVERTER need to be heated initially, and why heating is no longer necessary once the reaction has started. /3
- (c) On the energy profile diagram for (a), draw the reaction pathway if the catalyst were not used. /1
- (d) State the effect of the catalyst on the enthalpy of the reaction. /1
- (e) Identify from the flow chart the two raw materials that are added to the ABSORBER to convert the NO_2 into nitric acid. /2
- (f) Describe the disadvantage for the manufacturer if gases containing NO_2 are emitted from the factory. /2
2. Given that lithium is much more reactive than silver:
- (a) State which of the two elements is more likely to occur in nature uncombined with other elements. /1
- (b) State which of the two elements loses electrons to become positive ions more readily. /1
- 3.
- (a) State the four main stages in the production of metals from their ores. /1
- (b) Explain why not all stages are necessary in the production of some metals. /3
4. The stages in the electrolytic production of zinc from its ore are: concentration of the zinc mineral; conversion of the zinc mineral into a form suitable for reduction; electrolytic reduction.
- (a) Describe how the zinc mineral is concentrated. /3
- (b) Describe, using equations, how the concentrate is converted into a form suitable for reduction. /3
- (c) Describe using a diagram how the zinc is electrolysed from zinc sulfate. /2
5. Methods suitable for production of some metals may not be suitable for others.
- (a) Explain why the production of aluminium requires a molten (non-aqueous) electrolyte. State one disadvantage of this. /3
- (b) Explain why zinc and iron can be obtained by reduction using carbon whereas this is not possible for aluminium. /2
- (c) State the likely method of reduction of a calcium compound to obtain calcium, and state one reason for your answer. /2

TOTAL /34