• Explain the following features of the lead acid storage battery.

   It has a relatively constant voltage.

   It needs no salt bridge.

   It can be recharged.

• Explain why aluminium metal cannot be produced by the electrolysis of aqueous solutions of aluminium salts. Explain why aluminium is produced by the electrolysis of a molten mixture of Al₂O₃ and Na₃AlF₆ rather than by the electrolysis of molten Al₂O₃ alone.
Aluminium metal is a very effective agent for reducing oxides to their elements. For example, it is used as a component of the solid fuel in the space shuttle, and in the thermite reaction shown in lectures:

\[
\text{Fe}_2\text{O}_3(s) + 2\text{Al}(s) \rightarrow \text{Al}_2\text{O}_3(s) + 2\text{Fe}(s)
\]

Write a balanced equation for the reduction of SiO\(_2\)(s) to silicon by Al(s).

Given the following thermochemical data, evaluate the enthalpy change per gram of reactants for the SiO\(_2\) and Fe\(_2\)O\(_3\) reactions above.

<table>
<thead>
<tr>
<th>Compound</th>
<th>(\Delta H^\circ) (kJ mol(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe(_2)O(_3)</td>
<td>-821</td>
</tr>
<tr>
<td>Al(_2)O(_3)</td>
<td>-1668</td>
</tr>
<tr>
<td>SiO(_2)</td>
<td>-877</td>
</tr>
</tbody>
</table>

Answer (SiO\(_2\)): ____________________________  Answer (Fe\(_2\)O\(_3\)): ____________________________

Which set of reactants would make the better rocket fuel on the basis of most energy provided per mass of fuel (i.e. biggest “bounce per ounce”)?
At 773 K, the following reaction has an equilibrium constant, \(K_p\), of \(3.90 \times 10^{-3}\) atm\(^{-1}\).

\[
\frac{1}{2}N_2(g) + \frac{3}{2}H_2(g) \rightleftharpoons NH_3(g)
\]

If sufficient ammonia were introduced into an evacuated container at 773 K to give a pressure of 1.00 atm before any decomposition occurred, what would be the partial pressures of \(N_2\), \(H_2\) and \(NH_3\) at equilibrium?

\[P(N_2) = \quad P(H_2) = \quad P(NH_3) =\]