

## Question 2

This question is about the chemistry of air bags.

One method used to inflate air bags in cars is to use nitrogen produced chemically from the decomposition of sodium azide:

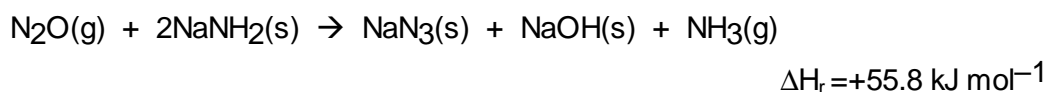


The sodium formed reacts with potassium nitrate to give more nitrogen:



- In what ratio (by mass) must the sodium azide and potassium nitrate be mixed in order that no metallic sodium remains after the reaction?
- Calculate the total mass of the solid mixture needed to inflate a  $60 \text{ dm}^3$  air bag at room temperature and atmospheric pressure.

The sodium azide is prepared commercially by the reaction between dinitrogen monoxide and sodium amide:



- Draw 'dot and cross' diagrams for dinitrogen monoxide and the azide anion.
- Using the information below, calculate  $\Delta H_r$  for reaction (1) above, the decomposition of sodium azide.

Compound	$\Delta H_f / \text{kJ mol}^{-1}$
$\text{N}_2\text{O}(\text{g})$	+82.0
$\text{NaNH}_2(\text{s})$	-123.7
$\text{NaOH}(\text{s})$	-425.2
$\text{NH}_3(\text{g})$	-46.1

Room temperature = 298 K; atmospheric pressure = 101325 Pa;

$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ .

The molar volume of an ideal gas is  $24.0 \text{ dm}^3$  at 298K.