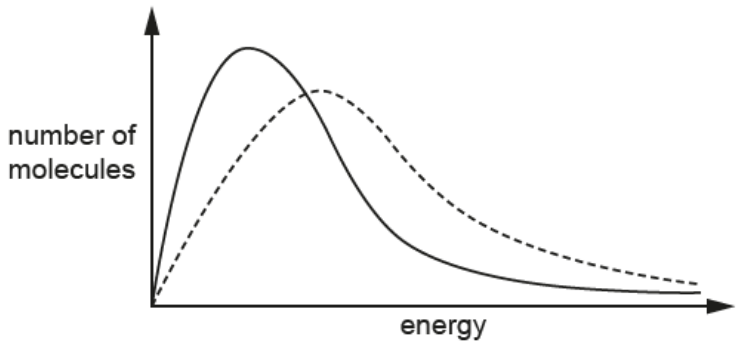
Reaction rates and equilibrium (qualitative) – 2021/20 GCE AS Chemistry A

1. Nov/2021/Paper_H032/01/No.11

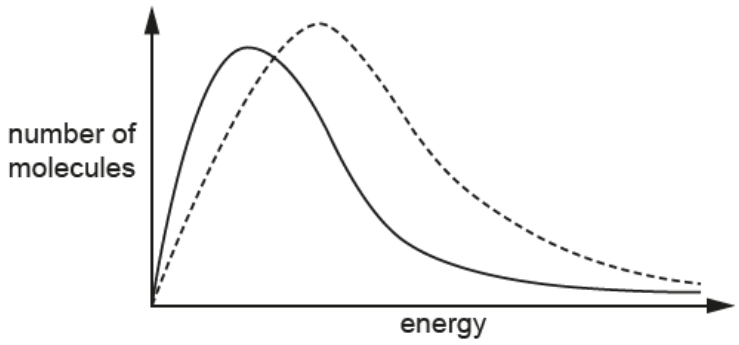
The Boltzmann distributions below show a gas at two different temperatures.

Which Boltzmann distribution shows the dotted curve at a higher temperature?

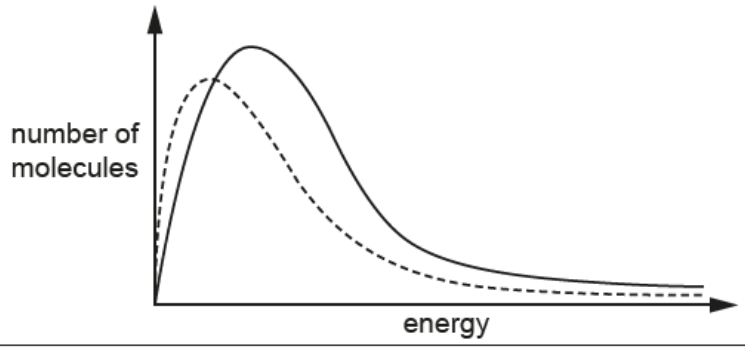
A



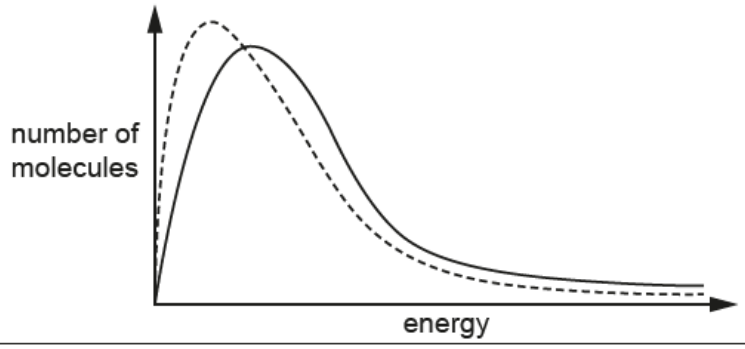
B



C



D



Your answer ☐ **[1]**

2. Nov/2020/Paper_H032/01/No.24(b)

(b) The industrial manufacture of NH_3 from N_2 and H_2 is carried out at an increased temperature and in the presence of a catalyst.

Explain, using Boltzmann distributions, why increasing the temperature and using a catalyst both increase the reaction rate.

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..... **[5]**

3. Nov/2021/Paper_H032/02/No.6

A student investigates the rate of reaction between strontium and water.

$Sr(s) + 2H_2O(l) \longrightarrow Sr(OH)_2(aq) + H_2(g)$

The student's method is shown below.

- Pour 100 cm^3 of water into a conical flask.
- Add 0.26 g of strontium and quickly connect a 100 cm^3 gas syringe.
- Measure the volume of gas produced every 10 seconds until all the strontium has reacted.

The student plots a graph of volume of gas produced against time as shown in **Fig. 6.1**.

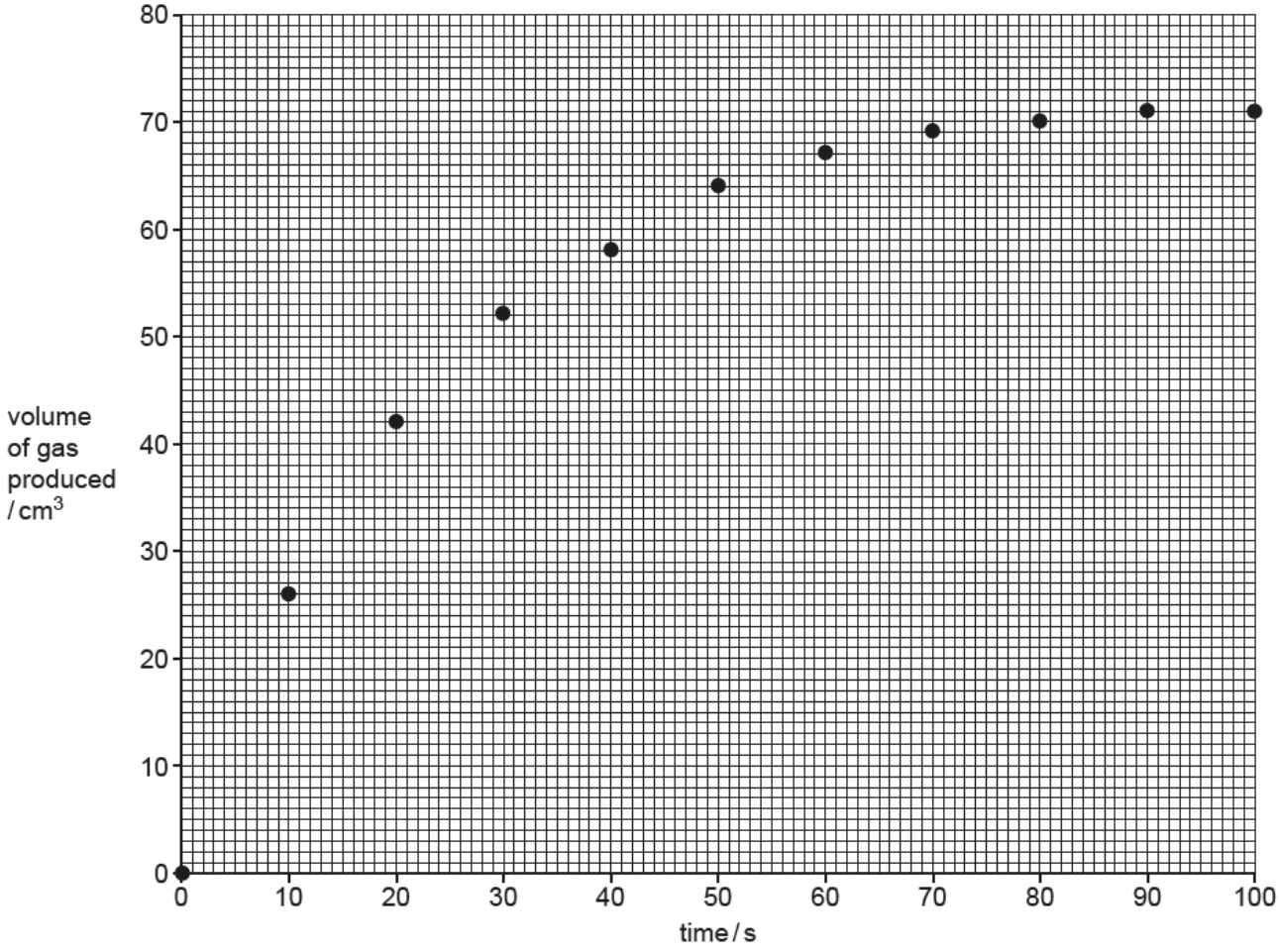

Fig. 6.1

(a) Draw a best fit curve on **Fig. 6.1**.
Use the graph to determine the rate of reaction, in $cm^3 s^{-1}$, at 50 s.

Show your working below and on the graph.

rate at 50 s ..... $cm^3 s^{-1}$ **[3]**

(b) A second student suggests that the experiment could be improved by measuring the loss in mass in the conical flask over time.

The student places a conical flask containing 100 cm^3 of water on a 2 decimal place balance, and then adds 0.26 g of strontium.

The mass is recorded every 10 seconds.

Suggest **one** advantage and **one** disadvantage of using this method compared to the gas collection method.

Advantage: .....

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Disadvantage: .....

..... **[2]**

(c) A third student repeats the original experiment using the same amount, in moles, of barium as strontium.

(i) Calculate the mass of barium that the student uses.

Give your answer to **2** decimal places.

mass of barium = ... g **[2]**

(ii) The student observes that the rate of reaction for barium is different from the rate of reaction with strontium.

On **Fig. 6.1** sketch the graph the student would obtain using barium instead of strontium. **[2]**

(iii) Describe and explain the difference in reactivity of barium and strontium with water.

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..... **[4]**