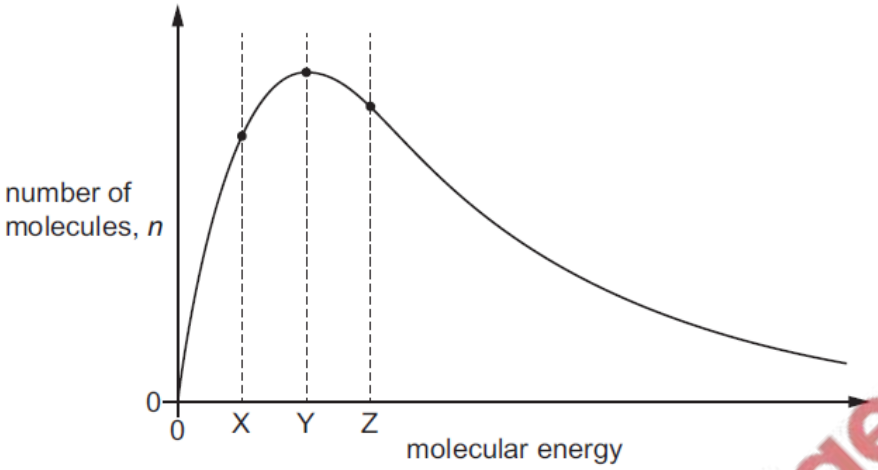
Reaction Kinetics – 2022 June AS Chemistry 9701

1. June/2022/Paper_11/No.15

The Boltzmann distribution for a gas at a constant temperature of 50 °C is shown.



If the temperature of the gas is **reduced** by 10 °C, the graph changes shape.

What happens to the values of *n* for the molecular energies X, Y and Z?

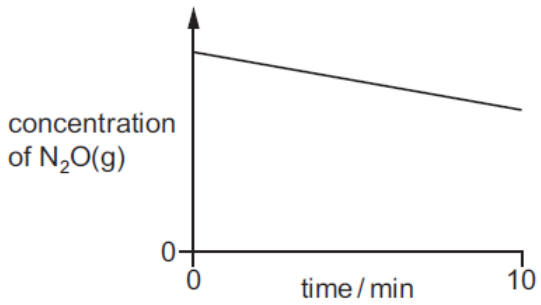
	X	Y	Z
A	higher	lower	higher
B	higher	lower	lower
C	lower	higher	lower
D	lower	lower	lower

2. June/2022/Paper_12/No.15

A large amount of $N_2O(g)$ decomposes into nitrogen gas and oxygen gas in the presence of a tiny amount of a gold foil catalyst.

The gold foil provides a solid surface on which the catalysed reaction takes place.

The graph shows the concentration of $N_2O(g)$ against time as it decomposes. The graph is a straight line.



Which row describes:

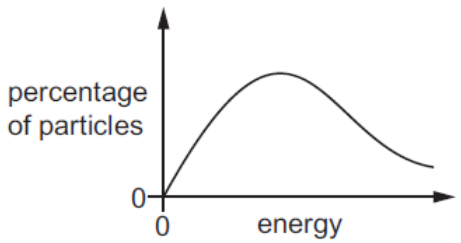
- the change in rate of reaction as $N_2O(g)$ decomposes from 0 to 10 minutes
- the effect of adding more gold foil catalyst on the rate of decomposition of the same amount and concentration of $N_2O(g)$?

	change in rate of reaction as $N_2O(g)$ decomposes	effect of adding more gold foil on the rate of decomposition
A	none	increases
B	none	none
C	decreases	increases
D	decreases	none

3. June/2022/Paper_13/No.15

The Boltzmann distribution of the particles in a mixture of gas X and gas Y is shown in diagram 1.

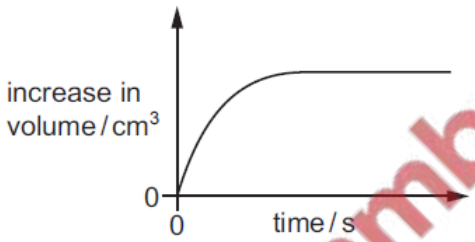
diagram 1



X and Y react and the reaction causes an increase in gas molecules present. The reaction goes to completion.

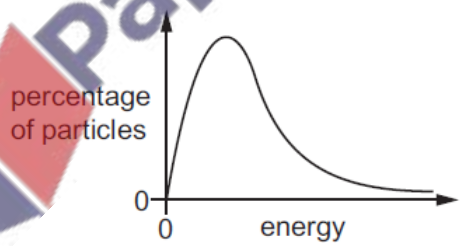
In experiment 1, the increase in volume is measured every 10 seconds. During the reaction, the temperature and pressure remain constant. The increase in volume is shown in the volume–time graph in diagram 2.

diagram 2

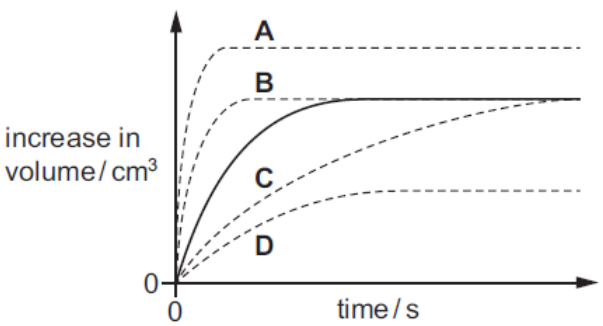


In experiment 2, the experiment is repeated using identical amounts of X and Y. A different temperature is used compared to experiment 1. The same pressure is used. The Boltzmann distribution of the second mixture of X and Y is shown in diagram 3. During the reaction the temperature and pressure remain constant.

diagram 3



Which curve on the volume–time graph would show the increase in volume against time for experiment 2? (The original line for experiment 1 is redrawn as a solid line.)



4. June/2022/Paper_13/No.16

When the temperature of a particular reaction is increased by 10 °C (e.g. from 20 °C to 30 °C) the rate of the reaction approximately doubles.

What is the **most** significant reason for this increase?

A a different mechanism for the reaction

B an increased collision frequency of the reactant molecules

C more collisions have energy greater than the activation energy

D a reduced activation energy for the reaction

5. June/2022/Paper_21/No.2(c)

(c) Solid Ra and Ca show similar reactions with H_2O, but the reactions occur at different rates.

Separate samples, each containing a single piece of solid Ra or Ca, are added to equal volumes of cold water.

Each sample contains equal numbers of moles of solid and the H_2O is in excess.

(i) Construct an equation for the reaction of Ra with H_2O.

..... [1]

(ii) Identify which element, Ra or Ca, reacts with H_2O at a faster rate. Suggest how the observations of each reaction would differ.

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..... [1]

(iii) Suggest why these reactions occur at different rates.

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..... [2]

(iv) One of the solutions is cloudy when the reaction has finished.

At the end of each reaction, universal indicator is added to each reaction mixture.

Suggest pH values of the solutions made in both reactions. Explain your answer.

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..... [2]

6. June/2022/Paper_23/No.3a(v)

(v) Fig. 3.2 shows the Boltzmann distribution of energies for molecules of **G** at constant temperature, T°C.

Sketch, on Fig. 3.2, the Boltzmann distribution of energies for molecules of **G** at a higher temperature, (T+100)°C.

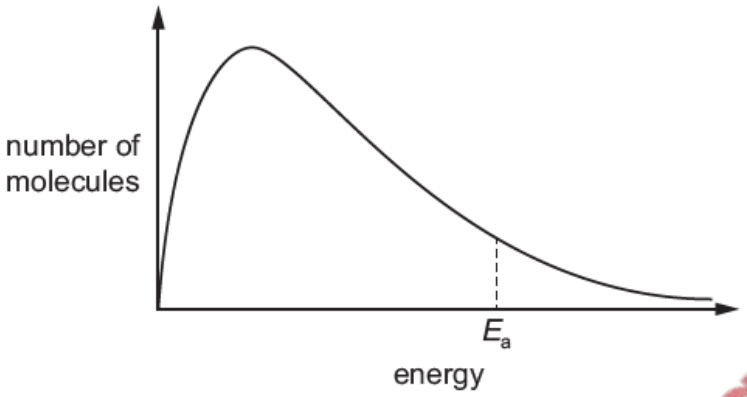

Fig. 3.2

[2]