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2002

XVIII

1583

Time allowed
19 Minutes

Score

/16

Percentage

%

CHEMISTRY

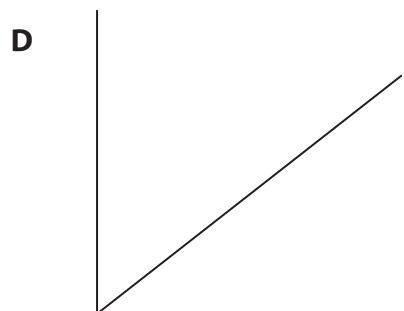
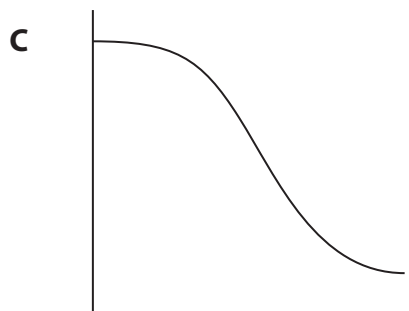
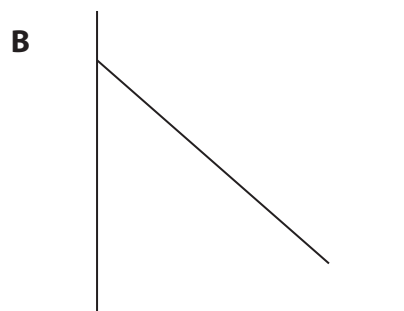
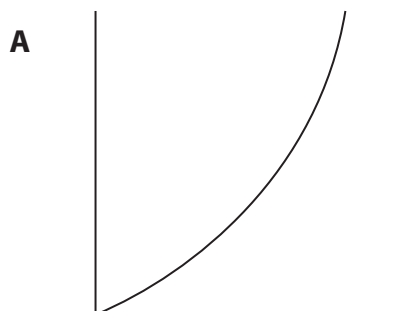
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Topic Questions

**Paper 2: Advanced Organic
and Physical Chemistry**

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1 Four sketch graphs are shown below.



(a) Which could be a graph of the concentration of a reactant, on the vertical axis, against time for a **zero** order reaction?

(1)

- A
- B
- C
- D

(b) Which could be a graph of rate of reaction, on the vertical axis, against the concentration of a reactant for a **first** order reaction?

(1)

- A
- B
- C
- D



(c) Which could be a graph of rate of reaction, on the vertical axis, against the square of the concentration of a reactant for a **second** order reaction?

(1)

A

B

C

D

(d) Which could be a graph of the concentration of a reactant, on the vertical axis, against time for a reaction which is catalysed by a product?

(1)

A

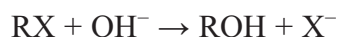
B

C

D

(Total for Question = 4 marks)

- 2 A halogenoalkane, RX, reacts with hydroxide ions, OH⁻, to form an alcohol.



The rate equation for the reaction is rate $k[\text{RX}]$. Which of these statements is **incorrect**?

- A Rate $\propto [\text{RX}]$.
- B RX is a primary halogenoalkane.
- C The reaction mechanism is S_N1.
- D A carbocation intermediate forms in the reaction.

(Total for Question 1 mark)

- 3 The rate equation for the reaction between hydrogen gas and nitrogen monoxide gas is

$$\text{rate } k[\text{NO}]^2[\text{H}_2]$$

If the concentration of both reactants is doubled, the rate will increase by a factor of

- A 3
- B 4
- C 6
- D 8

(Total for Question 1 mark)



- 4 A reaction has the rate equation rate $k[X][Y]^2[Z]$. The concentrations of each reactant are shown in the table below.

Reactant	Concentration / mol dm ⁻³
X	0.040
Y	0.20
Z	0.12

- (a) If the rate of reaction under these conditions has a value of $0.24 \text{ mol dm}^{-3} \text{ s}^{-1}$, then the numerical value of k is (1)

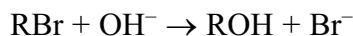
- A 0.00080
 B 0.533
 C 1.875
 D 1250

- (b) The units for the rate constant, k , are (1)

- A mol⁻³ dm⁹ s⁻¹
 B mol³ dm⁹ s⁻¹
 C mol⁻³ dm⁻⁹ s⁻¹
 D mol³ dm⁻⁹ s⁻¹

(Total for Question 2 marks)

5 The equation below shows the hydrolysis of a bromoalkane.



For a particular bromoalkane, the rate equation is

The bromoalkane, RBr, is most likely to be $\text{rate} = k[\text{RBr}]$

- A CH_3Br
- B $\text{CH}_3\text{CH}_2\text{Br}$
- C $(\text{CH}_3)_3\text{CCH}_2\text{Br}$
- D $(\text{CH}_3)_3\text{CBr}$

(Total for Question 1 mark)

6 Propanone reacts with iodine in acidic solution as shown in the equation below.



The rate equation for the reaction is

$$\text{Rate} = k[\text{CH}_3\text{COCH}_3(\text{aq})][\text{H}^+(\text{aq})]$$

(a) The most appropriate technique to investigate the rate of this reaction is

- A titrating samples of reaction mixture with acid.
- B measurement of optical activity.
- C measurement of the volume of gas given off.
- D colorimetry.

(1)

(b) Which statement about the reaction is **not** correct?

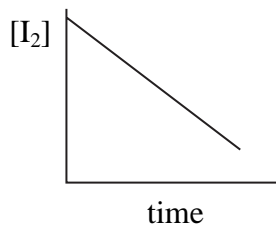
- A The overall order of reaction is second order.
- B The units of the rate constant are $\text{dm}^3 \text{mol}^{-1} \text{s}^{-1}$.
- C The rate constant increases with temperature.
- D The rate increases four times when the concentration of propanone and iodine are both doubled.

(1)

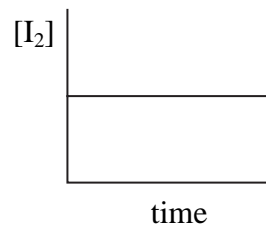
(c) The reaction is carried out using a large excess of both propanone and acid.
Which of the graphs below shows the change of iodine concentration with time?

(1)

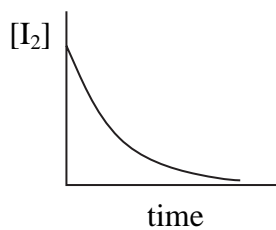
A



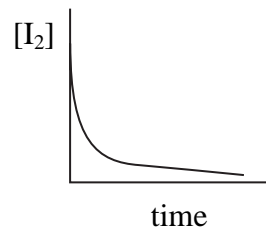
B



C



D



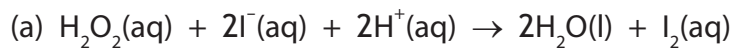
(Total for Question = 3 marks)



7 Methods for investigating reaction rates include

- A colorimetry
- B collecting and measuring the volume of a gas
- C quenching, followed by titration with acid
- D quenching, followed by titration with iodine solution.

Which method would be most suitable to investigate the rate of the following reactions?



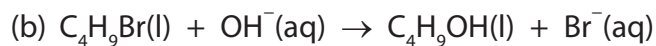
(1)

A

B

C

D



(1)

A

B

C

D

(Total for Question = 2 marks)

8 For a given initial reactant pressure, the half-life for a first order gaseous reaction was found to be 30 minutes.

If the experiment were repeated at half the initial reactant pressure, the half-life would be

A 15 minutes.

B 30 minutes.

C 45 minutes.

D 60 minutes.

(Total for Question = 1 mark)

- 9 To determine the activation energy (E_a) for a reaction, the variation of reaction rate with temperature is investigated.

The rate constant, k , for the reaction is related to the absolute temperature, T , by the expression

$$\ln k = -\frac{E_a}{R} \times \left(\frac{1}{T}\right) + \text{constant}$$

where R is the gas constant.

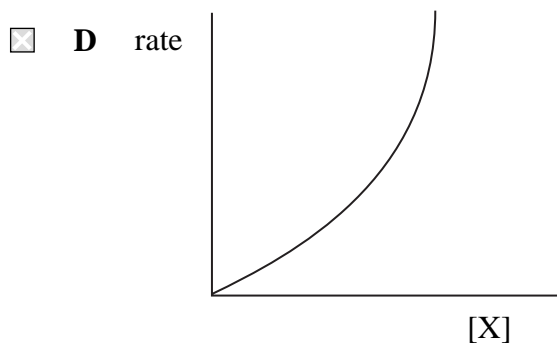
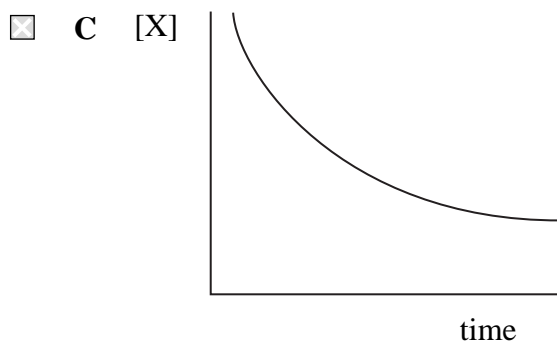
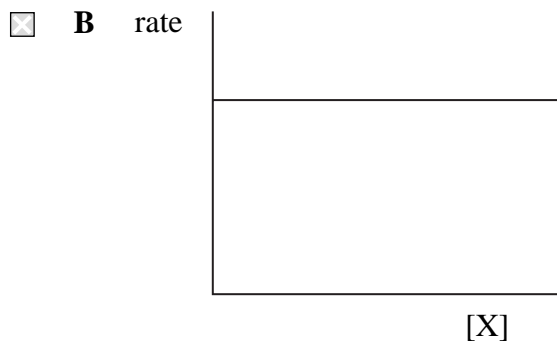
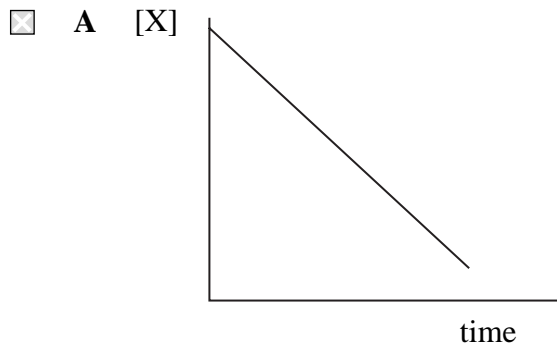
The activation energy for the reaction could be obtained by plotting a graph of

	vertical axis	horizontal axis
<input type="checkbox"/> A	k	T
<input type="checkbox"/> B	k	$\frac{1}{T}$
<input type="checkbox"/> C	$\ln k$	T
<input type="checkbox"/> D	$\ln k$	$\frac{1}{T}$

(Total for Question = 1 mark)

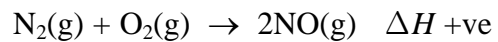


10 Which of the following graphs shows that a reaction is first order with respect to reactant **X**?





11 Which of the following changes will lead to the greatest increase in the **rate** of the following endothermic reaction?



		Temperature	Initial concentration of N ₂ and O ₂
<input type="checkbox"/>	A	decrease by 15 %	decrease by 15 %
<input type="checkbox"/>	B	increase by 15 %	stay the same
<input type="checkbox"/>	C	decrease by 15 %	increase by 15 %
<input type="checkbox"/>	D	increase by 15 %	increase by 15 %

(Total for Question = 1 mark)