Kinetics Multiple Choice Provincial Exam Practice

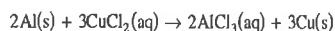1.

Which of the following could **not** be units for reaction rate?

A. sec^{-1}
B. g/mL
C. M/min
D. $°C/hour$

A. 1
B. 2
C. 3
D. 4

2.

Which of the following represents the typical mathematical relationship between reaction rate and time?

A.
Rate
Time

B.
Rate
Time

C.
Rate
Time

D.
Rate
Time

A. 1
B. 2
C. 3
D. 4

3.

Consider the reaction:
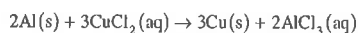
$$2Al(s) + 3CuCl_2(aq) \rightarrow 2AlCl_3(aq) + 3Cu(s)$$

What is the rate of Al consumption in mol/min if 0.98 g Cu are produced in 2.5 minutes?

A. $4.1 \times 10^{-3} \, mol/min$
B. $6.2 \times 10^{-3} \, mol/min$
C. $9.3 \times 10^{-3} \, mol/min$
D. $3.9 \times 10^{-1} \, mol/min$

A. 1
B. 2
C. 3
D. 4

4.

Consider the following reaction:

$$2Al(s) + 3CuCl_2(aq) \rightarrow 3Cu(s) + 2AlCl_3(aq)$$
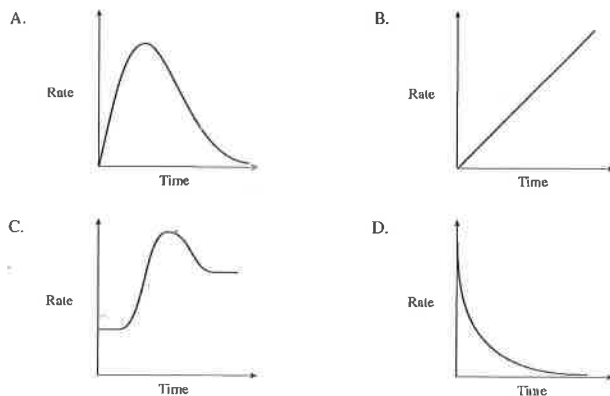
If 0.56 g Cu is produced in 1.0 minute, what mass of Al is used up in 20.0 seconds?

A. 0.053 g
B. 0.12 g
C. 0.16 g
D. 0.37 g

. 1
B. 2
C. 3
D. 4

5.

Consider the following reaction:

$$CH_3COOH(aq) + NaHCO_3(s) \rightarrow NaCH_3COO(aq) + CO_2(g) + H_2O(\ell)$$

Which of the following properties could best be used to measure the reaction rate?

A. the volume of CO_2
B. the volume of H_2O
C. the mass of CH_3COOH
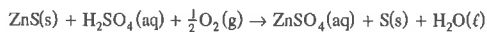D. the surface area of $NaHCO_3$

A. 1
B. 2
C. 3
D. 4

6.

Which of the following describes what happens to the KE and PE as an activated complex forms products?

	KE	PE
A.	decreases	increases
B.	decreases	decreases
C.	increases	increases
D.	increases	decreases

A. 1
B. 2
C. 3
D. 4

7.

Consider the reaction:

$$ZnS(s) + H_2SO_4(aq) + \frac{1}{2}O_2(g) \rightarrow ZnSO_4(aq) + S(s) + H_2O(\ell)$$

What would increase the fraction of successful collisions?

I	increasing temperature
II	increasing surface area of ZnS
III	increasing $[H_2SO_4]$
IV	adding a suitable catalyst

A. I and II only
B. I and IV only
C. II and III only
D. I, II, III and IV

A. 1
B. 2
C. 3
D. 4

8.

Consider the following reaction:

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$
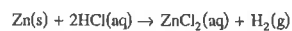
In two different experiments, equal moles of Zn and equal volumes of HCl are reacted. After 2 minutes, the volume of H_2 produced is recorded as follows:

	Zn	Temp	[HCl]	Volume H_2 (mL)
Experiment 1	strip	10°C	10.0 M	10.6
Experiment 2	powdered	15°C	3.0 M	7.3

Which of the following factors explains why the rate in Experiment 1 is different than the rate in Experiment 2?

A. [HCl]
B. temperature
C. nature of reactants
D. surface area of Zn

A. 1
B. 2
C. 3
D. 4

9.

Which of the following would have a positive value for ΔH?

I.	the evaporation of water
II.	the burning of a match
III.	the explosive reaction between H_2 and O_2
IV.	a chemical cold pack

A. III only
B. IV only
C. I and IV
D. II and III

A. 1
B. 2
C. 3
D. 4

10.

Consider the following two reactions occurring under the same conditions:

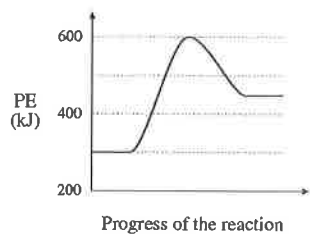| I	$C_2H_5Cl(\ell) \rightarrow C_2H_4(g) + HCl(g)$	$E_a = 254\,kJ$
II	$C_2H_5Br(\ell) \rightarrow C_2H_4(g) + HBr(g)$	$E_a = 219\,kJ$

Which of the following is correct?

A. Reaction I is faster because it has a higher E_a.
B. Reaction II is faster because it has a lower E_a.
C. Reaction I is slower because it is exothermic.
D. Reaction II is slower because it is endothermic.

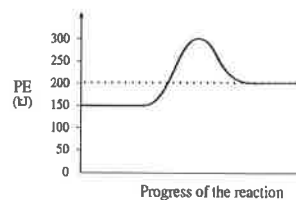A. 1
B. 2
C. 3
D. 4

11.

Consider the following PE diagram:

Progress of the reaction

Which of the following is true for the forward reaction?

	ΔH	E_a (kJ)
A.	−150	300
B.	−150	600
C.	+150	300
D.	+150	600

A. 1
B. 2
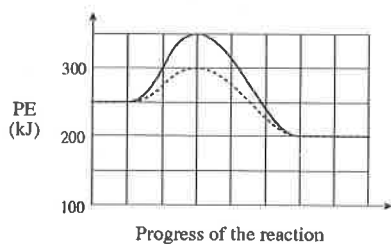C. 3
D. 4

12.

Progress of the reaction

Which of the following are the values for the activation energy (E_a) and change in enthalpy (ΔH) for the reverse reaction?

	E_a (kJ)	ΔH (kJ)
A.	300	−50
B.	150	+50
C.	100	−50
D.	100	+50

A. 1
B. 2
C. 3
D. 4

13.

Consider the following PE diagram:

Progress of the reaction

Which of the following is true for the **reverse reaction**?

		ΔH	E_a
A.	catalyzed	−50 kJ	100 kJ
B.	catalyzed	+50 kJ	150 kJ
C.	uncatalyzed	−50 kJ	100 kJ
D.	uncatalyzed	+50 kJ	150 kJ

A. 1
B. 2
C. 3
D. 4

14.

An uncatalyzed reaction has the following values for E_a:

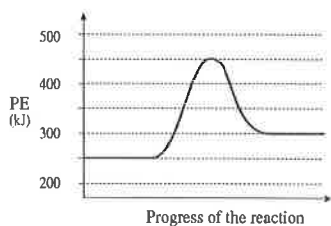$$E_{a(forward)} = 250 \text{ kJ}$$

$$E_{a(reverse)} = 100 \text{ kJ}$$

If a catalyst is added to the reaction, which of the following values could be correct?

	$E_{a(forward)}$ (kJ)	$E_{a(reverse)}$ (kJ)	$\Delta H_{(forward)}$ (kJ)
A.	50	200	−150
B.	50	200	+150
C.	200	50	−150
D.	200	50	+150

A. 1
B. 2
C. 3
D. 4

15.

Consider the following PE diagram for a reversible reaction:

Progress of the reaction

Which of the following correctly corresponds to the diagram above?

	PE of activated complex (kJ)	$E_{a(reverse)}$ (kJ)	$\Delta H_{(forward)}$ (kJ)
A.	150	200	+50
B.	200	150	-50
C.	450	150	+50
D.	450	300	+50

A. 1
B. 2
C. 3
D. 4

16.
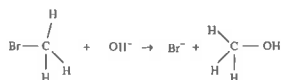
Which of the following represents the value for the activation energy of the forward reaction in an equilibrium system?

A. $E_{a(forward)} = E_{a(reverse)} + (\Delta H)$
B. $E_{a(forward)} = E_{a(reverse)} - (\Delta H)$
C. $E_{a(forward)} = (\Delta H) - E_{a(reverse)}$
D. $E_{a(forward)} = -(\Delta H) - E_{a(reverse)}$

A. 1
B. 2
C. 3
D. 4

17.

Consider the following reaction:

Which of the following could be true of the activated complex?

	Structure	PE (relative to reactants)
A.		lower
B.		lower
C.		higher
D.		higher

A. 1
B. 2
C. 3
D. 4

18.

Step 1:	$2NO \rightarrow N_2O_2$	(fast)
Step 2:	$N_2O_2 + H_2 \rightarrow N_2O + H_2O$	(slow)
Step 3:	$N_2O + H_2 \rightarrow N_2 + H_2O$	(fast)

Increasing the concentration of which of the following substances would cause the greatest increase in the reaction rate?

A. H_2
B. NO
C. N_2O
D. H_2O

A. 1
B. 2
C. 3
D. 4

19.

Step 1:	$2NO \rightarrow N_2O_2$	(fast)
Step 2:	$N_2O_2 + H_2 \rightarrow N_2O + H_2O$	(slow)
Step 3:	$N_2O + H_2 \rightarrow N_2 + H_2O$	(fast)

Which of the following are products in the overall reaction?

I	N_2
II	N_2O_2
III	N_2O
IV	H_2O

A. I and II only
B. I and IV only
C. II and III only
D. III and IV only

A. 1
B. 2
C. 3
D. 4

20.

Step 1	$NO + O_2 \rightarrow OONO$
Step 2	$\boxed{?} + OONO \rightarrow 2NO_2$
Overall	$2NO + O_2 \rightarrow 2NO_2$

What substance is missing in Step 2?

	Missing Substance
A.	O_2
B.	NO
C.	NO_2
D.	OONO

A. 1
B. 2
C. 3
D. 4

21.

Step 1	$NO + O_2 \rightarrow OONO$
Step 2	$\boxed{?} + OONO \rightarrow 2NO_2$
Overall	$2NO + O_2 \rightarrow 2NO_2$

Which of the following substances could represent an activated complex from the above mechanism?

	Activated Complex
A.	O_2
B.	NO
C.	NO_2
D.	N_2O_4

A. 1
B. 2
C. 3
D. 4

22.

Consider the following reaction mechanism:

Step 1:	$C_2H_5HgI \rightarrow C_2H_5Hg^+ + I^-$
Step 2:	$C_2H_5Hg^+ + Cl^- \rightarrow \boxed{Particle\ 1}$
Overall	$C_2H_5HgI + Cl^- \rightarrow C_2H_5HgCl + I^-$

Identify Particle 1 and a reaction intermediate from the above mechanism.

	Particle 1	Reaction Intermediate
A.	$C_2H_5Hg^+$	C_2H_5HgI
B.	C_2H_5HgI	$C_2H_5Hg^+$
C.	C_2H_5HgCl	I^-
D.	C_2H_5HgCl	$C_2H_5Hg^+$

A. 1
B. 2
C. 3
D. 4