Higher Unit 1 – Tutorial Sheet

Please attempt the following questions in preparation for the online session on 24th October.

1. In which of the following will both changes result in an increase in the rate of a chemical reaction?

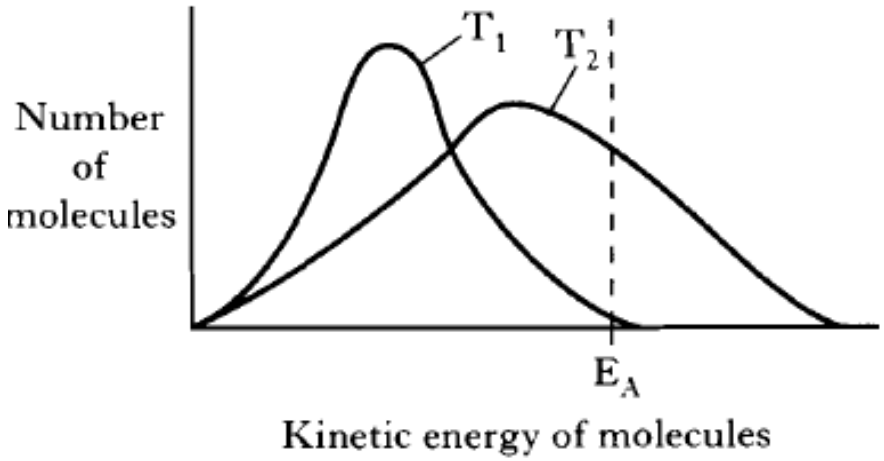
A. An increase in temperature and an increase in the particle size.

B. A decrease in activation energy and an increase in the frequency of collisions.

C. An increase in activation energy and a decrease in particle size.

D. An increase in concentration and a decrease in the surface area of the reactant particles. **(1)**

2.

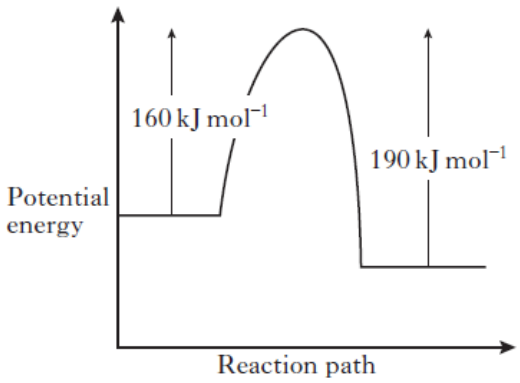


Which of the following is the correct interpretation of the above energy distribution diagram for a reaction as the temperature decreases from T_2 to T_1?

	Activation energy (E_a)	Number of Successful Collisions
A	Remains the same	Decreases
B	Decreases	Decreases
C	Decreases	Increases
D	Remains the same	Increases

(1)

3.



When a catalyst is used, the activation energy of the forward reaction is reduced to 35 kJ mol^{-1}. What is the activation energy of the catalysed reverse reaction?

A. 30 kJ mol^{-1}

B. 35 kJ mol^{-1}

C. 190 kJ mol^{-1}

D. 65 kJ mol^{-1} **(1)**

4. Which of the following equations represents the first ionisation energy of fluorine?

A. $F^-(g) \rightarrow F(g) + e^-$

B. $F^-(g) \rightarrow \frac{1}{2} F_2(g)\ e^-$

C. $F(g) \rightarrow F^+(g) + e^-$

D. $\frac{1}{2}F_2(g) \rightarrow F^+(g) + e^-$ **(1)**

5. Which of the following atoms has least attraction for bonding electrons?

A. Carbon

B. Nitrogen

C. Phosphorus

D. Silicon **(1)**

6. Which of the following is not an example of a van der Waals' force?

A. Covalent bond

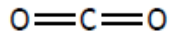
B. Hydrogen bond

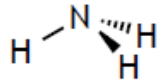
C. London dispersion force

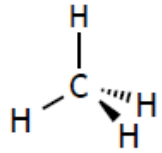
D. Permanent dipole – permanent dipole attraction **(1)**

7. Which of the following has more than one type of van der Waals' force operating between its molecules in the liquid state?

A 

B 

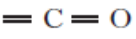
C 

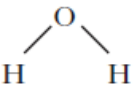
D 

(1)

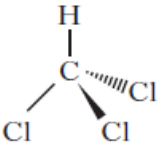
8. The shapes of some common molecules are shown below and each contains at least one polar bond.

Which molecule is non-polar?

A 

B 

C 

D 

(1)

9. Which of the following chlorides is likely to have least ionic character?

A. $CaCl_2$

B. $BeCl_2$

C. LiCl

D. CsCl **(1)**

10. Which of the following elements would have the strongest London dispersion forces?

A. Argon

B. Chlorine

C. Nitrogen

D. Oxygen

(1)

11. The reaction of oxalic acid with an acidified solution of potassium permanganate was studied to determine the effect of temperature changes on reaction rate.

$$5(COOH)_2(aq) + 6H^+(aq) + 2MnO_4^-(aq) \rightarrow 2Mn^{2+}(aq) + 10CO_2(g) + 8H_2O(l)$$

The reaction was carried out at several temperatures between 40°C and 60°C. The end of the reaction was indicated by a colour change from purple to colourless.

(a) State two factors that should be kept the same in these experiments.

(1)

(b) Why might it be difficult to measure an accurate value for the reaction time when the reaction is carried out at room temperature?

(1)

12. (a) Complete the table below by adding the types of bonding and structure for each of the elements listed.

Name of Element	Bonding and structure at room temperature and pressure
Sodium	
Neon	
Phosphorus	
Silicon	
Chlorine	
Bromine	

(3)

(b) Why do metallic solids such as sodium conduct electricity?

(1)

(c) Explain why the covalent radius of sulfur is smaller than that of phosphorus.

(1)

(d) The melting point of sulfur is much higher than that of phosphorus.

Explain fully, in terms of the structures of sulfur and phosphorus molecules and the intermolecular forces between molecules of each element, why the melting point of sulfur is much higher than that of phosphorus.

(3)

13. Hydrogen cyanide, HCN, is highly toxic.

Structure	H-C≡N
Molecular mass	27
Boiling point / °C	26

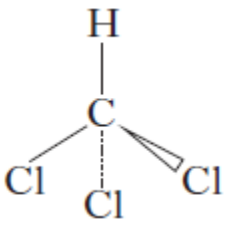
Although hydrogen cyanide has a similar molecular mass to nitrogen, it has a much higher boiling point. This is due to the permanent dipole–permanent dipole attractions in liquid hydrogen cyanide.

What is meant by permanent dipole–permanent dipole attractions?

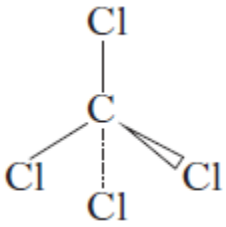
Explain how they arise in liquid hydrogen cyanide.

(2)

14. The structures below show molecules that contain chlorine atoms.



Trichloromethane



Tetrachloromethane

The compounds shown above are not very soluble in water.

Trichloromethane is around ten times more soluble in water than tetrachloromethane.

Explain clearly why trichloromethane is more soluble in water than tetrachloromethane.

(3)