

A Level Chemistry Diagnostic Test 1

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Set by: T. Editor

Please be aware that for tests your answer to each question **will be visible to your teacher(s) after you submit your test** so that they can provide further feedback and support if they wish to do so.

Assignments are different. We do not share with your teachers any of your entered answers or the number of your attempts to questions in assignments.

Instructions

This test will give you a broad idea of which topics you most need to spend more time on in your revision.

There is a total of **24** multiple-choice questions, divided into **5** sections.

Test sections

- [Stoichiometry and Acids/Bases](#)
- [Kinetics and Equilibria](#)
- [Enthalpy and Entropy](#)
- [Inorganic Chemistry](#)
- [Organic Chemistry](#)

Click 'Start' when you are ready to begin the test.

Stoichiometry and Acids/Bases

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1. In a titration, a 25.0 cm^3 aliquot of sulfuric acid (H_2SO_4) reacted with 22.0 cm^3 of 0.10 mol dm^{-3} sodium hydroxide (NaOH) solution. What was the concentration of the sulfuric acid in the aliquot?

- ☐ $0.044 \text{ mol dm}^{-3}$
- ☐ $0.088 \text{ mol dm}^{-3}$
- ☐ 0.11 mol dm^{-3}
- ☐ There is not enough information to determine the concentration.

2. Carbon monoxide reacts with oxygen to create carbon dioxide. What volume of oxygen is necessary to fully react with 1.00 dm^3 of carbon monoxide?

- ☐ 2.00 dm^3
- ☐ 1.00 dm^3
- ☐ 0.500 dm^3
- ☐ 0.250 dm^3

3. Which of the following is a correct defining description for a Brønsted–Lowry base?

- ☐ A Brønsted–Lowry base is neutralised by accepting electrons.
- ☐ A Brønsted–Lowry base is a proton donor.
- ☐ A Brønsted–Lowry base is a proton acceptor.
- ☐ A Brønsted–Lowry base fully dissociates in solution, releasing hydroxide ions.

4. To what concentration would a solution of $0.500 \text{ mol dm}^{-3}$ HCl be diluted for the pH to increase by two units?

- ☐ A hundred-fold dilution to $0.125 \text{ mol dm}^{-3}$ HCl will increase the pH by two units.
- ☐ The pH will decrease when the acid is diluted.

- ☐ A four-fold dilution to $0.125 \text{ mol dm}^{-3}$ HCl will increase the pH by two units.
- ☐ The pH will not change when the acid is diluted.

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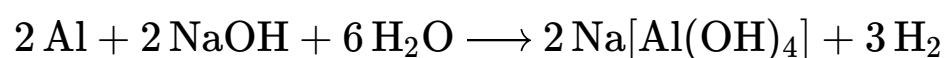


Kinetics and Equilibria

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5. Which of the following is the correct rate equation for the reaction between sodium hydroxide and aluminium?



- ☐ $\text{rate} = k[\text{Na}[\text{Al}(\text{OH})_4]]^2[\text{H}_2]^3$
- ☐ $\text{rate} = k[\text{Al}][\text{NaOH}][\text{H}_2\text{O}]$
- ☐ There is not enough information to determine the rate equation.
- ☐ $\text{rate} = k[\text{Al}]^2[\text{NaOH}]^2[\text{H}_2\text{O}]^6$

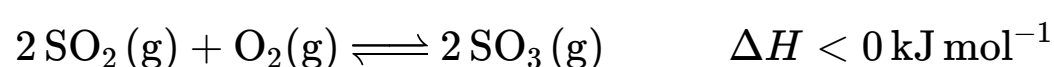
6. The rate of a reaction is observed to increase when the temperature is increased. Which of the following does **not** contribute to this?

- ☐ The particles have higher kinetic energy at higher temperatures.
- ☐ The particles collide more frequently at higher temperatures.
- ☐ The activation energy for the reaction is reached in a higher proportion of collisions at higher temperature.
- ☐ The activation energy for the reaction is lower at higher temperatures.

7. A catalyst is introduced into a reaction mixture. Which of the following statements correctly describes what happens as a result?

- ☐ The concentration of all reagents increases.
- ☐ The equilibrium constant for the reaction increases.
- ☐ The particles have more energy when they collide.
- ☐ An alternative pathway with a lower activation energy arises.

8. Which conditions for the following equilibrium will favour a high yield of the product, $\text{SO}_3(\text{g})$?



- ☐ Low temperature and high pressure
- ☐ High temperature and low pressure
- ☐ Low temperature and low pressure
- ☐ High temperature and high pressure

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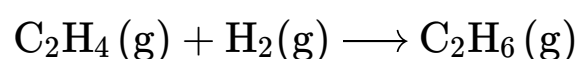
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Enthalpy and Entropy

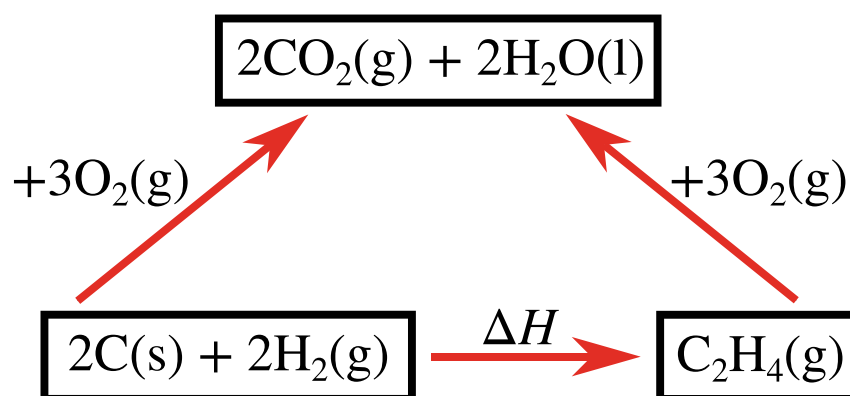
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9. Express the enthalpy change for the following reaction in terms of bond enthalpies:



- ☐ $\text{BE}(\text{C}-\text{H}) - \text{BE}(\text{C}-\text{C}) - \text{BE}(\text{H}-\text{H}) + \text{BE}(\text{C}=\text{C})$
- ☐ $\text{BE}(\text{H}-\text{H}) + \text{BE}(\text{C}=\text{C}) - \text{BE}(\text{C}-\text{H}) - \text{BE}(\text{C}-\text{C})$
- ☐ $\text{BE}(\text{H}-\text{H}) + \text{BE}(\text{C}=\text{C}) - 2\text{BE}(\text{C}-\text{H}) - \text{BE}(\text{C}-\text{C})$
- ☐ $2\text{BE}(\text{C}-\text{H}) - \text{BE}(\text{C}-\text{C}) - \text{BE}(\text{H}-\text{H}) + \text{BE}(\text{C}=\text{C})$

10. Express the enthalpy change of formation of ethene in terms of the relevant enthalpy changes of combustion.



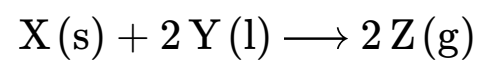
- ☐ $\Delta H = 2\Delta H_c(\text{C}) + 2\Delta H_c(\text{H}_2) + \Delta H_c(\text{C}_2\text{H}_4)$
- ☐ $\Delta H = 3\Delta H_c(\text{C}) + 3\Delta H_c(\text{H}_2) + 3\Delta H_c(\text{C}_2\text{H}_4)$
- ☐ $\Delta H = 3\Delta H_c(\text{C}) + 3\Delta H_c(\text{H}_2) - 3\Delta H_c(\text{C}_2\text{H}_4)$
- ☐ $\Delta H = 2\Delta H_c(\text{C}) + 2\Delta H_c(\text{H}_2) - \Delta H_c(\text{C}_2\text{H}_4)$

11. If a reaction is described as exothermic, what can we definitely conclude?

- ☐ It is fast.
- ☐ It is spontaneous at any temperature.

- ☐ It is spontaneous, but only at high enough temperatures.
- ☐ None of the above
-

12. Which of the following conclusions about the reaction equation provided is valid?



- ☐ The enthalpy change is negative.
- ☐ The enthalpy change is positive.
- ☐ The entropy change is negative.
- ☐ The entropy change is positive.

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Inorganic Chemistry

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13. Which of the following reactions corresponds to the event relevant for the second ionisation energy of magnesium?

- ☐ $\text{Mg(g)} \longrightarrow \text{Mg}^{2+}(\text{g}) + 2\text{e}^{-}$
☐ $\text{Mg}^{+}(\text{g}) \longrightarrow \text{Mg}^{2+}(\text{g}) + \text{e}^{-}$
☐ $\text{Mg(g)} + 2\text{e}^{-} \longrightarrow \text{Mg}^{2-}(\text{g})$
☐ $\text{Mg}^{-}(\text{g}) + \text{e}^{-} \longrightarrow \text{Mg}^{2-}(\text{g})$

14. How many bonds does carbon usually form and why?

- ☐ 2 because it has 6 valence electrons to share and will have a full octet when forming 2 covalent bonds
☐ 4 because it has 4 valence electrons to share and will have a full octet when forming 4 covalent bonds
☐ 6 because it needs to lose 6 electrons to have a full outer shell (noble gas configuration)
☐ 4 because it needs to lose 4 electrons to have a full outer shell (noble gas configuration)

15. Which entry in the table correctly describes the types of particles present in the different chemical species?

	HCl(g)	HCl(aq)	Na(s)	NaCl(s)
<input type="radio"/>	Molecules	Molecules	Atoms	Ions
<input type="radio"/>	Molecules	Ions	Atoms	Ions
<input type="radio"/>	Molecules	Ions	Ions	Molecules
<input type="radio"/>	Ions	Ions	Atoms	Molecules

16. Why does the reactivity of alkaline metals generally increase going down the group?

- ☐ Going down the group, the nuclear charge increases, so the repulsion felt by the valence electrons is greater and they are easier to lose.
 - ☐ Going down the group, the nuclear charge increases, so the attraction felt by the incoming electrons is greater and they are easier to gain.
 - ☐ Going down the group, the incoming electrons feel a smaller repulsion from the nucleus as the higher shells' orbitals are on average further away from the nucleus, so the electrons are easier to gain.
 - ☐ Going down the group, the valence electrons feel a smaller attraction from the nucleus as the higher shells' orbitals are on average further away from the nucleus, so the electrons are easier to lose.
-

17. Which of the following explains why transition metals behave differently to main group metals?

- ☐ Transition metals can use both their s and their p electrons as valence electrons.
 - ☐ Transition metals have an exactly half-full subshell.
 - ☐ Transition metals always exist as alloys.
 - ☐ Transition metals have, or form ions that have, a partially-filled d-subshell.
-

18. Which of the following **cannot** act as a ligand in a transition metal complex?

- ☐ H_2O
 - ☐ NH_4^+
 - ☐ OH^-
 - ☐ NH_3
-

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Organic Chemistry

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19. Which of the following can be used to easily distinguish between an aldehyde and a ketone, and what is the expected observation?

- ☐ Bromine water: decolourisation is observed with the aldehyde but not the ketone
- ☐ Silver nitrate: a white precipitate forms with the aldehyde but a yellow precipitate forms with the ketone
- ☐ Sodium carbonate: effervescence is seen with the aldehyde but not the ketone
- ☐ Tollens' reagent: a silver mirror is seen for the aldehyde but not the ketone

20. Which of the following descriptions of how cyclohexene and benzene react are correct?

- ☐ Cyclohexene undergoes nucleophilic substitution, benzene undergoes nucleophilic addition
- ☐ Cyclohexene undergoes electrophilic substitution, benzene undergoes electrophilic addition
- ☐ Cyclohexene undergoes nucleophilic addition, benzene undergoes nucleophilic substitution
- ☐ Cyclohexene undergoes electrophilic addition, benzene undergoes electrophilic substitution

21. What product do you expect to obtain when ethanal reacts with potassium dichromate?

- ☐ ethanoic acid
- ☐ ethanal (no reaction)
- ☐ ethanol
- ☐ ethanone

22. What does a monomer for addition polymerisation usually need to contain?

- ☐ an aromatic ring
- ☐ a C=C double bond
- ☐ two different functional groups

☐ a chloride group

23. An organic compound shows a strong, sharp absorption between 1700 cm^{-1} and 1750 cm^{-1} in its IR spectrum. What could this compound be?

☐ $\text{CH}_2=\text{CHCH}_2\text{C}(=\text{O})\text{H}$

☐ $\text{CH}_2=\text{CHCH}=\text{CH}_2$

☐ $\text{CH}_2=\text{CHCH}_2\text{CH}_2\text{OH}$

☐ $\text{CH}_2=\text{CHC}\equiv\text{CH}$

24. Which of the following is the main product when HBr reacts with 2-methylbut-1-ene?

☐ 1-bromo-2-methylbutane

☐ 1,2-dibromo-2-methylbut-1-ene

☐ 1,2-dibromo-2-methylbutane

☐ 2-bromo-2-methylbutane

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