

Brett Robbins Academic Consulting

Chemistry 30 Practice Test

Unit A: Thermochemistry

25 Questions

Original practice questions written to the Alberta curriculum, in the style of past diploma examinations. Work through each question, then check your answers with the key at the end.

This practice test was made by AI and there may be mistakes. If a question or answer looks wrong, contact Brett for clarification.

Question 1

Which of the following statements correctly compares photosynthesis and cellular respiration?

- A) Photosynthesis is exothermic, and cellular respiration is endothermic.
- B) Photosynthesis is endothermic, and cellular respiration is exothermic.
- C) Both photosynthesis and cellular respiration are endothermic.
- D) Both photosynthesis and cellular respiration are exothermic.

Question 2

The reaction of nitrogen gas with oxygen gas to form nitrogen monoxide gas is represented by the following equation.



Which of the following statements about this reaction is correct?

- A) The reaction is exothermic, and energy is released to the surroundings.
- B) The reaction is endothermic, and the products have less potential energy than the reactants.
- C) The reaction is endothermic, and energy would be written as a reactant in the equation.
- D) The reaction is endothermic, and the value of ΔH is -180.6 kJ .

Question 3

A chemical reaction occurring in a calorimeter releases energy that is absorbed by 250.0 g of water, raising the temperature of the water by 8.0°C .

The energy transferred to the water, in kJ, is ____.

Question 4

On a potential energy diagram for a chemical reaction, the reactants are at 80 kJ, the activated complex is at 130 kJ, and the products are at 30 kJ.

The activation energy and the enthalpy change for this reaction are shown in row

A) Activation energy : 50 kJ

Enthalpy change : - 50 kJ

B) Activation energy : 130 kJ

Enthalpy change : - 50 kJ

C) Activation energy : 50 kJ

Enthalpy change : + 50 kJ

D) Activation energy : 100 kJ

Enthalpy change : - 110 kJ

Question 5

A catalyst increases the rate of a chemical reaction by

A) increasing the potential energy of the products

B) decreasing the enthalpy change of the reaction

C) increasing the activation energy of the reaction

D) providing an alternative pathway with a lower activation energy

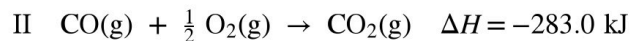
Question 6

Methanol, $\text{CH}_3\text{OH}(\text{l})$, burns completely in oxygen. The molar enthalpy of combustion of methanol is - 726 kJ/mol, and its molar mass is 32.05 g/mol.

The energy released when 64.1 g of methanol is burned completely, in kJ, is ____.

Question 7

Use the following equations to answer this question.



The enthalpy change for the reaction $\text{C(s)} + \frac{1}{2} \text{O}_2\text{(g)} \rightarrow \text{CO(g)}$ is

A) -676.5 kJ

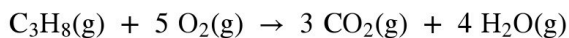
B) $+110.5 \text{ kJ}$

C) -55.3 kJ

D) -110.5 kJ

Question 8

The complete combustion of propane gas is represented by the following equation.



The molar enthalpies of formation are $\text{C}_3\text{H}_8\text{(g)} - 103.8$, $\text{CO}_2\text{(g)} - 393.5$,

and $\text{H}_2\text{O(g)} - 241.8 \text{ kJ/mol}$. The enthalpy change for the reaction is

A) -2043.9 kJ

B) -2219.9 kJ

C) -2147.7 kJ

D) $+2043.9 \text{ kJ}$

Question 9

A student burns 0.500 g of ethanol, $\text{C}_2\text{H}_5\text{OH(l)}$, (molar mass 46.08 g/mol)

in a calorimeter containing 100.0 g of water. The temperature of the water

increases by 12.4°C . The energy released per mole of ethanol burned, in kJ/mol , is ____.

Question 10

On a potential energy diagram, the reactants are at 20 kJ and the products are at 95 kJ. A catalyst lowers the activated complex from 145 kJ to 100 kJ.

For the catalyzed reaction, the activation energy and the enthalpy change are shown in row

A) Activation energy : 80 kJ

Enthalpy change : + 75 kJ

B) Activation energy : 80 kJ

Enthalpy change : – 75 kJ

C) Activation energy : 45 kJ

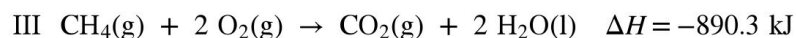
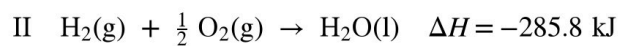
Enthalpy change : + 75 kJ

D) Activation energy : 125 kJ

Enthalpy change : + 75 kJ

Question 11

Use the following equations to answer this question.



The molar enthalpy of formation of methane, $\text{CH}_4\text{(g)}$, is

A) –965.1 kJ/mol

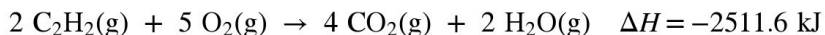
B) +74.8 kJ/mol

C) –74.8 kJ/mol

D) –1855.4 kJ/mol

Question 12

The combustion of acetylene gas is represented by the following equation.



The energy released when one mole of $\text{C}_2\text{H}_2(\text{g})$ burns completely, in kJ, is ____.

Question 13

Methanol can be produced by the following reaction.



If the molar enthalpy of formation of $\text{CO}(\text{g})$ is -110.5 kJ/mol , then the molar enthalpy of formation of $\text{CH}_3\text{OH}(\text{l})$ is

- | | |
|----------------------------|----------------------------|
| A) -17.6 kJ/mol | B) -238.6 kJ/mol |
| C) -128.1 kJ/mol | D) $+238.6 \text{ kJ/mol}$ |

Question 14

A student designs an experiment to compare the molar enthalpies of combustion of three different fuels. In each trial, a sample of fuel is burned to heat the same mass of water in the same calorimeter. The variables in this experiment are shown in row

A) Manipulated variable : the mass of water

Responding : temperature change of the water; Controlled : the type of fuel

B) Manipulated variable : the type of fuel

Responding : temperature change of the water; Controlled : the mass of water

C) Manipulated variable : the type of fuel

Responding : the mass of water; Controlled : the temperature change of the water

D) Manipulated variable : the temperature change of the water

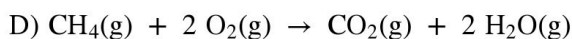
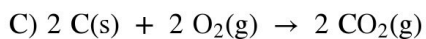
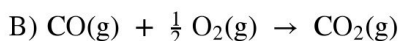
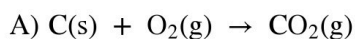
Responding : the type of fuel; Controlled : the mass of water

Question 15

A student mixes 50.0 mL of 1.00 mol/L HCl(aq) with 50.0 mL of 1.00 mol/L NaOH(aq) in a calorimeter. The total mass of the resulting solution is 100.0 g, and its temperature increases by 6.6 °C. The energy released per mole of water formed in this neutralization, in kJ/mol, is ____.

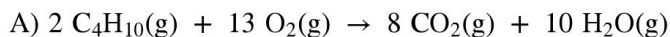
Question 16

Which of the following equations represents the formation reaction for carbon dioxide gas?

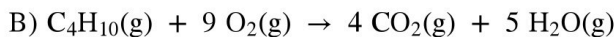


Question 17

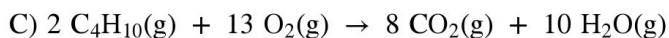
The balanced equation for the complete combustion of butane, $\text{C}_4\text{H}_{10}\text{(g)}$, and the sign of the enthalpy change for the reaction are shown in row



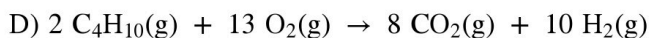
Sign of ΔH : negative



Sign of ΔH : negative



Sign of ΔH : positive



Sign of ΔH : negative

Question 18

A student burns 1.80 g of glucose, $\text{C}_6\text{H}_{12}\text{O}_6(\text{s})$, (molar mass 180.16 g/mol) in a calorimeter containing 500.0 g of water. The temperature of the water increases by 13.4°C . The energy released per mole of glucose burned, in kJ/mol, is ____.

Question 19

Ammonia gas reacts with oxygen gas as represented by the following equation.



The molar enthalpies of formation are $\text{NH}_3(\text{g}) - 45.9$, $\text{NO}(\text{g}) + 90.3$, and $\text{H}_2\text{O}(\text{g}) - 241.8$ kJ/mol. The enthalpy change for the reaction is

- | | |
|-----------------|-----------------|
| A) -1089.6 kJ | B) -1273.2 kJ |
| C) $+906.0$ kJ | D) -906.0 kJ |

Question 20

Photosynthesis is represented by the following equation.

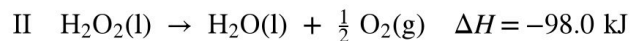
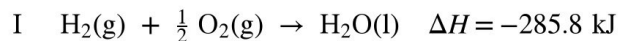


The energy absorbed when 36.0 g of glucose (molar mass 180.16 g/mol) is produced by this process is

- | | |
|--------------------------|--------------------------|
| A) 1.68×10^4 kJ | B) 5.60×10^2 kJ |
| C) 2.80×10^3 kJ | D) 9.34×10^1 kJ |

Question 21

Use the following equations to answer this question.



The enthalpy change for the formation of hydrogen peroxide, $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}_2(\text{l})$, is

A) -383.8 kJ

B) $+187.8 \text{ kJ}$

C) -187.8 kJ

D) -98.0 kJ

Question 22

When methane is burned in a calorimeter, the temperature of the water increases.

The water gains *i* energy, and the reacting methane system loses *ii* energy.

The types of energy are shown in row

A) *i*: potential; *ii*: kinetic

B) *i*: kinetic; *ii*: potential

C) *i*: kinetic; *ii*: kinetic

D) *i*: potential; *ii*: potential

Question 23

Ethanol, $\text{C}_2\text{H}_5\text{OH}(\text{l})$, has a molar enthalpy of combustion of -1367 kJ/mol

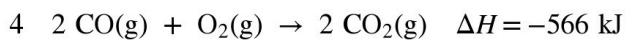
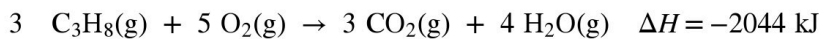
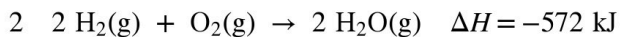
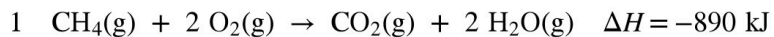
and a molar mass of 46.08 g/mol . A 2.30 g sample of ethanol is burned completely

to heat 750.0 g of water in a calorimeter. The increase in the temperature

of the water, in $^{\circ}\text{C}$, is ____.

Question 24

The following reactions represent the complete combustion of four different fuels.



The reaction that releases the greatest amount of energy per mole of fuel burned is

A) 1

B) 2

C) 3

D) 4

Question 25

A chemical reaction has an enthalpy change of $+120 \text{ kJ}$ and an activation energy of 240 kJ for the forward reaction. The activation energy for the reverse reaction is

A) 360 kJ

B) 240 kJ

C) 60 kJ

D) 120 kJ

Answer Key

- | | | |
|---------|----------|----------|
| 1. B | 10. A | 19. D |
| 2. C | 11. C | 20. B |
| 3. 8.37 | 12. 1256 | 21. C |
| 4. A | 13. B | 22. B |
| 5. D | 14. B | 23. 21.7 |
| 6. 1452 | 15. 55.2 | 24. C |
| 7. D | 16. A | 25. D |
| 8. A | 17. A | |
| 9. 478 | 18. 2805 | |

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