NUNAVUT CHEMISTRY 30 · UNIT A · 25 QUESTIONS

Thermochemistry — Practice Test

This practice test was made by AI and there may be mistakes. If a question or answer looks wrong, use the Flag a mistake button to let Brett know so he can fix it.

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.

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

$N_2(g) + O_2(g) \rightarrow 2\ NO(g) \quad \Delta H = +180.6\ kJ$

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.

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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 ____.**

ANSWER _____

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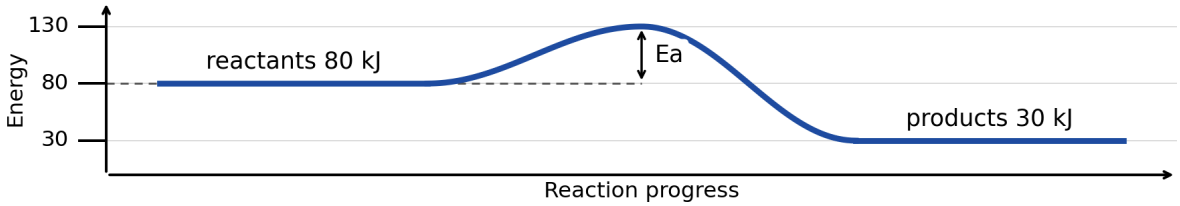
4 **The diagram shows the potential energy profile for a chemical reaction. The enthalpy change and the classification of the reaction are shown in row**



A Enthalpy change: -50 kJ; Classification: exothermic

B Enthalpy change: +50 kJ; Classification: endothermic

C Enthalpy change: -50 kJ; Classification: endothermic

D Enthalpy change: +50 kJ; Classification: exothermic

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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

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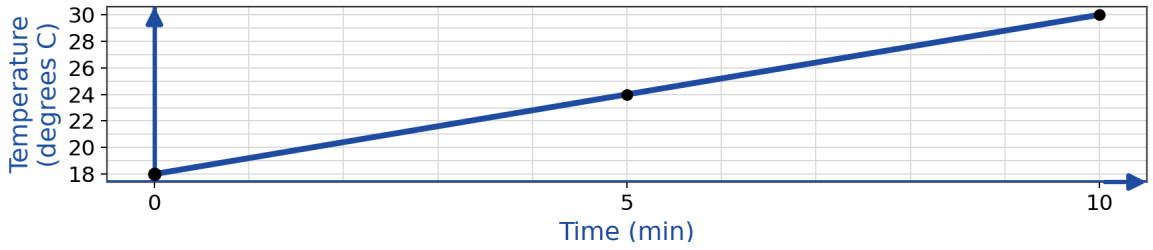
6 **The graph shows the temperature of water in a calorimeter as energy is transferred to the water. The water has a mass of 200.0 g, and c = 4.184 J/(g· ° C). The energy transferred to the water, in kJ, is ____.**



ANSWER _____

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7 **Use the following equations to answer this question.**

I $C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H = -393.5\ kJ$

II $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g) \quad \Delta H = -283.0\ kJ$

The enthalpy change for the reaction $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$ is

A -676.5 kJ

B +110.5 kJ

C -55.3 kJ

D -110.5 kJ

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

$C_3H_8(g) + 5\ O_2(g) \rightarrow 3\ CO_2(g) + 4\ H_2O(g)$

The molar enthalpy of formation for $C_3H_8(g)$: -103.8 kJ/mol, for $CO_2(g)$: -393.5 kJ/mol, and for $H_2O(g)$: -241.8 kJ/mol. The enthalpy change for the reaction is

- A -2043.9 kJ
- B -2219.9 kJ
- C -2147.7 kJ
- D +2043.9 kJ

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9 **A student burns 0.500 g of ethanol, $C_2H_5OH(l)$, (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 ____.**

ANSWER _____

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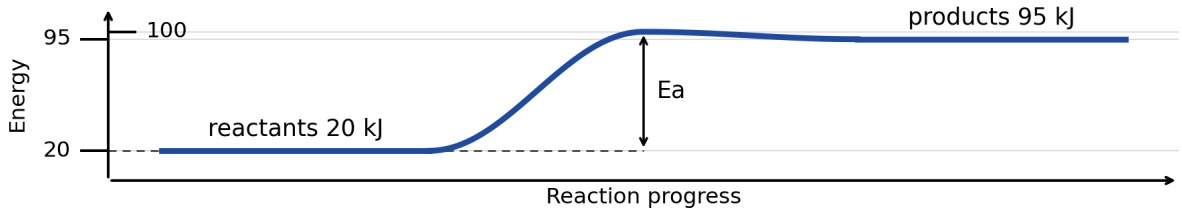
10 **The diagram shows the potential energy profile for a chemical reaction. The activation energy for the reverse reaction, compared with the activation energy for the forward reaction, is**



A greater than the forward activation energy

B less than the forward activation energy

C equal to the forward activation energy

D impossible to determine from the diagram

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11 **Use the following equations to answer this question.**

I $C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H = -393.5\ kJ$

II $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l) \quad \Delta H = -285.8\ kJ$

III $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l) \quad \Delta H = -890.3\ kJ$

The molar enthalpy of formation of methane, $CH_4(g)$, is

A -965.1 kJ/mol

B +74.8 kJ/mol

C -74.8 kJ/mol

D -1855.4 kJ/mol

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

$2\ C_2H_2(g) + 5\ O_2(g) \rightarrow 4\ CO_2(g) + 2\ H_2O(g) \quad \Delta H = -2511.6\ kJ$

The energy released when one mole of $C_2H_2(g)$ burns completely, in kJ, is ____.

ANSWER

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13 **Methanol can be produced by the following reaction.**

$CO(g) + 2\ H_2(g) \rightarrow CH_3OH(l) \quad \Delta H = -128.1\ kJ$

If the molar enthalpy of formation of CO(g) is -110.5 kJ/mol, then the molar enthalpy of formation of $CH_3OH(l)$ is

A -17.6 kJ/mol

B -238.6 kJ/mol

C -128.1 kJ/mol

D +238.6 kJ/mol

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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

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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 ____.**

ANSWER _____

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

- **A** $C(s) + O_2(g) \rightarrow CO_2(g)$
- **B** $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$
- **C** $2\ C(s) + 2\ O_2(g) \rightarrow 2\ CO_2(g)$
- **D** $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(g)$

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17 **The balanced equation for the complete combustion of butane, $C_4H_{10}(g)$, and the sign of the enthalpy change for the reaction are shown in row**

- **A** $2\ C_4H_{10}(g) + 13\ O_2(g) \rightarrow 8\ CO_2(g) + 10\ H_2O(g)$ Sign of Δ H: negative
- **B** $C_4H_{10}(g) + 9\ O_2(g) \rightarrow 4\ CO_2(g) + 5\ H_2O(g)$ Sign of Δ H: negative
- **C** $2\ C_4H_{10}(g) + 13\ O_2(g) \rightarrow 8\ CO_2(g) + 10\ H_2O(g)$ Sign of Δ H: positive
- **D** $2\ C_4H_{10}(g) + 13\ O_2(g) \rightarrow 8\ CO_2(g) + 10\ H_2(g)$ Sign of Δ H: negative

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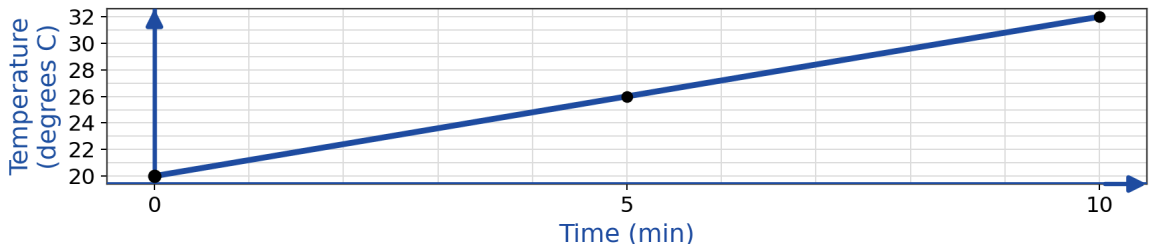
18 **The graph shows the temperature of water in a calorimeter during a combustion reaction. The water has a mass of 400.0 g, and c = 4.184 J/(g· ° C). The energy transferred to the water, in kJ, is ____.**



ANSWER _____

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

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$

The molar enthalpy of formation for $NH_3(g)$: -45.9 kJ/mol, for NO(g): +90.3 kJ/mol, and for $H_2O(g)$: -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

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20 **Photosynthesis is represented by the following equation.**

$6\ CO_2(g) + 6\ H_2O(l) \rightarrow C_6H_{12}O_6(s) + 6\ O_2(g) \quad \Delta H = +2803\ kJ$

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

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21 **Use the following equations to answer this question.**

I $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\Delta H = -285.8$ kJ

II $H_2O_2(l) \rightarrow H_2O(l) + \frac{1}{2}O_2(g)$ $\Delta H = -98.0$ kJ

The enthalpy change for the formation of hydrogen peroxide, $H_2(g) + O_2(g) \rightarrow H_2O_2(l)$, is

A -383.8 kJ

B +187.8 kJ

C -187.8 kJ

D -98.0 kJ

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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

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23 **Ethanol, $C_2H_5OH(l)$, 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 °C, is ____.**

ANSWER _____

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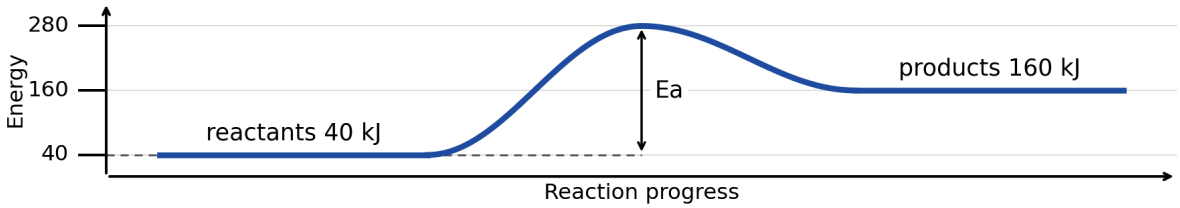
24 **The diagram shows the potential energy profile for a chemical reaction. The enthalpy change for the reaction shown, in kJ, is**



A +120 kJ

B -120 kJ

C +240 kJ

D -240 kJ

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25 **A chemical reaction has an enthalpy change of +120 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

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ANSWER KEY

1.	B	**10.**	B	**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.	10.04	**15.**	55.2	**24.**	A
7.	D	**16.**	A	**25.**	D
8.	A	**17.**	A		
9.	478	**18.**	20.1		

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