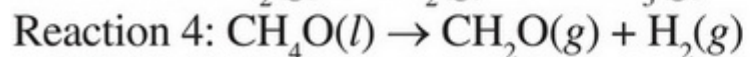## Real AP Past Papers with Multiple-Choice Questions

Questions 1-5 refer to the following information.
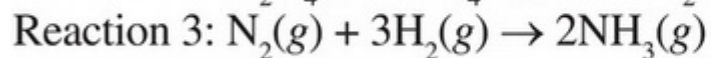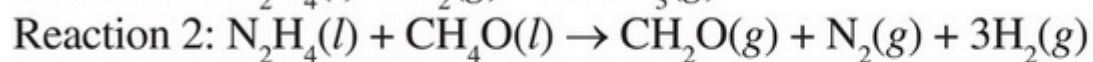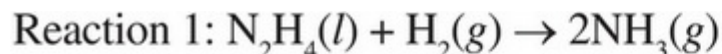
Reaction 1: $N_2H_4(l) + H_2(g) \rightarrow 2NH_3(g)$ $\Delta H = ?$
Reaction 2: $N_2H_4(l) + CH_4O(l) \rightarrow CH_2O(g) + N_2(g) + 3H_2(g)$ $\Delta H = -37 \text{ kJ/mol}_{rxn}$
Reaction 3: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ $\Delta H = -46 \text{ kJ/mol}_{rxn}$
Reaction 4: $CH_4O(l) \rightarrow CH_2O(g) + H_2(g)$ $\Delta H = -65 \text{ kJ./mol}_{rxn}$

1. What is the enthalpy change for reaction 1?

○ A. -148 kJ/mol$_{rxn}$

○ B. -56 kJ/mol$_{rxn}$

○ C. -18 kJ/mol$_{rxn}$

○ D. +148 kJ/mol$_{rxn}$

2. If reaction 2 were repeated at a higher temperature, how would the reaction's value for ΔG be affected?

○ A. It would become more negative because entropy is a driving force behind this reaction.

○ B. It would become more positive because the reactant molecules would collide more often.

○ C. It would become more negative because the gases will be at a higher pressure.

○ D. It will stay the same; temperature does not affect the value for ΔG.

3. Under what conditions would reaction 3 be thermodynamically favored?

○ A. It is always favored.

○ B. It is never favored.

○ C. It is only favored at low temperatures.

○ D. It is only favored at high temperatures.

4. If 64 g of CH_4O were to decompose via reaction 4, approximately how much energy would be released or absorbed?

○ A. 65 kJ of energy will be absorbed.

○ B. 65 kJ of energy will be released.

○ C. 130 kJ of energy will be absorbed.

○ D. 130 kJ of energy will be released.

5. A 2.0 L flask holds 0.40 g of helium gas. If the helium is evacuated into a larger container while the temperature is held constant, what will the effect on the entropy of the helium be?

○ A. It will remain constant because the number of helium molecules does not change.

○ B. It will decrease because the gas will be more ordered in the larger flask.

○ C. It will decrease because the molecules will collide with the sides of the larger flask less often than they did in the smaller flask.

○ D. It will increase because the gas molecules will be more dispersed in the larger flask.

6. $2Al(s) + 3Cl_2(g) \rightarrow 2AlCl_3(s)$

The reaction above is not thermodynamically favored under standard conditions, but it becomes thermodynamically favored as the temperature decreases toward absolute zero. Which of the following is true at standard conditions?

○ A. ΔS and ΔH are both negative.

○ B. ΔS and ΔH are both positive.

○ C. ΔS is negative, and ΔH is positive.

○ D. ΔS is positive, and ΔH is negative.

to be 1.02 g/mL. Which of the following expressions will correctly calculate the heat gained by the water as the $NaNO_3$ dissolves? Assume the volume of the solution remains unchanged.

○ A. $(25.0)(4.18)(2.2)$

○ B. $\dfrac{(26.5)(4.18)(2.2)}{1.02}$

○ C. $\dfrac{(1.02)(4.18)(2.2)}{1.50}$

○ D. $(25.0)(1.02)(4.18)(2.2)$

**8.** $SF_4(g) + H_2O(l) \rightarrow SO_2(g) + 4HF(g)$ $\Delta H = -828$ kJ/mol
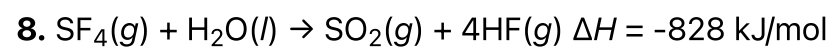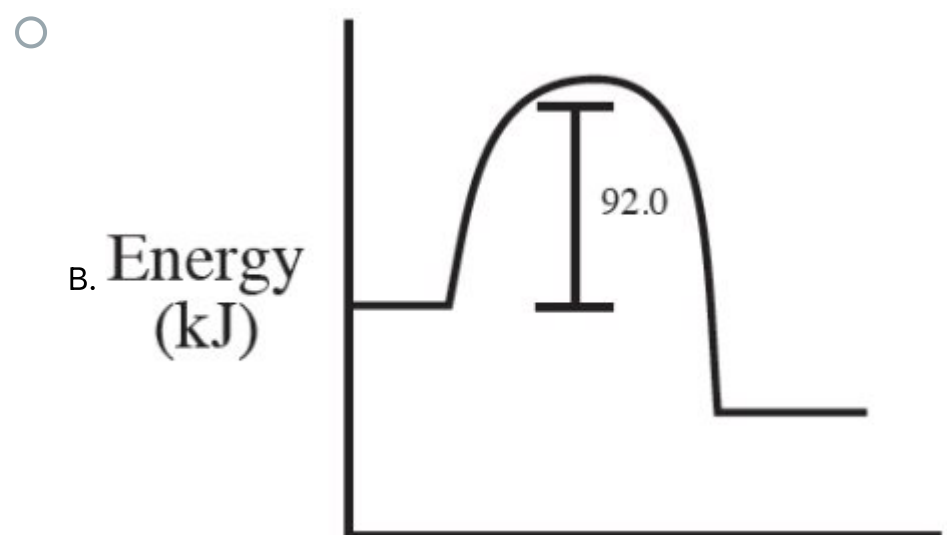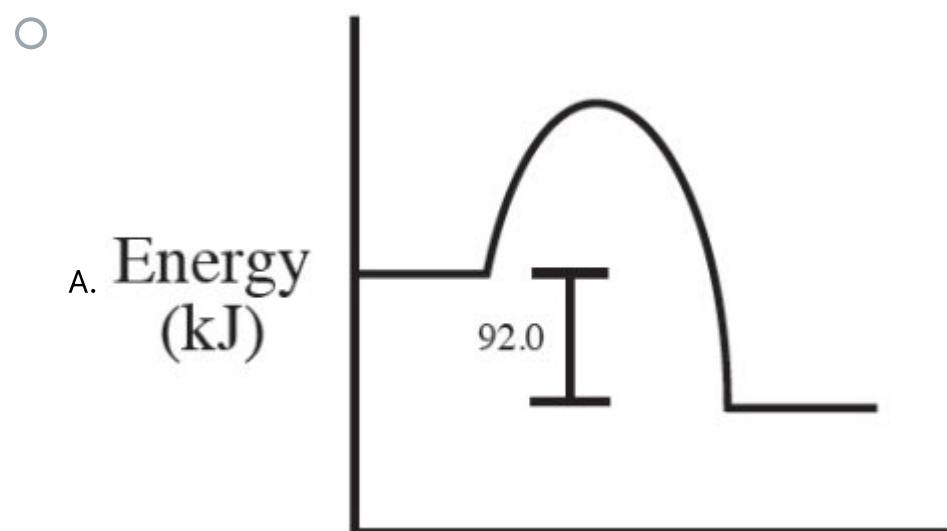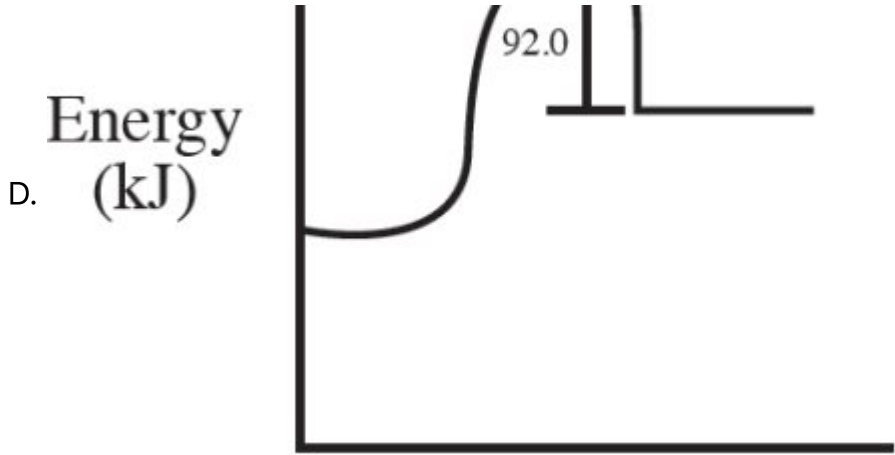
Which of the following statements accurately describes the above reaction?

○ A. The entropy of the reactants exceeds that of the products.

○ B. $H_2O(l)$ will always be the limiting reagent.

○ C. This reaction is never thermodynamically favored.

○ D. The temperature of the surroundings will increase as this reaction progresses.

9. $C(s) + 2S(s) \rightarrow CS_2(l)$ $\Delta H = +92.0$ kJ/mol
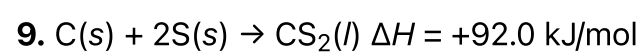
Which of the following energy level diagrams gives an accurate representation of the above reaction?

○

A. Energy (kJ) — 92.0

○

B. Energy (kJ) — 92.0

○

C. Energy (kJ) — 92.0

Energy
(kJ)

D.

92.0
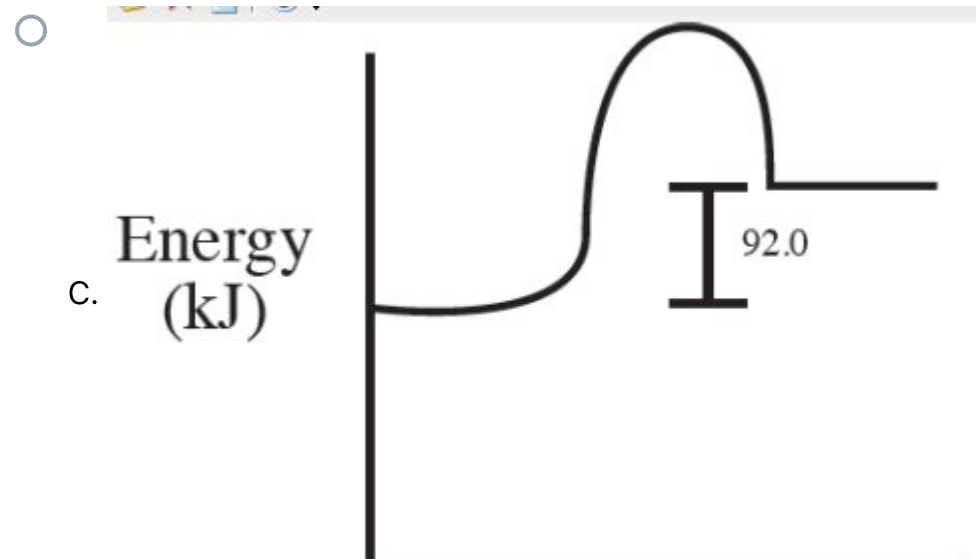
10. A student studies two solutions. Solution A has a volume of 100 mL and is at a temperature of 25.0°C. Solution B has a volume of 1000 mL and is at a temperature of 22.0°C. Which of the following statements must be true regarding both solutions?

○ A. Solution A has more heat than solution B.

○ B. The specific heat capacity of solution A is greater than that of solution B.

○ C. If the solutions were to be mixed, heat would transfer from B to A.

○ D. Solution B has more thermal energy than solution A.

11. $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

Based on the information given in the table below, what is $\Delta H°$ for the above reaction?

Bond	Average bond energy (kJ/mol)
H-H	500
O=O	500
O-H	500

○ A. -2,000 kJ

○ B. -500 kJ

○ C. +1,000 kJ

○ D. +2,000 kJ

12. $H_2O(l) \rightarrow H_2O(s)$

Which of the following is true for the above reaction at 298 K?

○ A. The value for ΔS is positive.

○ B. The value for ΔG is zero.

○ C. The value for ΔH is positive.

○ D. The reaction is favored.

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