1. How much heat is released when 8.0 g of methane gas is burned, according to the following equation:

$$CH_{4\,(g)} + 2O_{2\,(g)} \rightarrow CO_{2\,(g)} + 2H_2O_{(l)} \qquad \Delta H^o = -890 \text{ kJ}$$

A) 1050 kJ B) 445 kJ C) 256 kJ D) 625 kJ

---

2. The internal energy **ΔE** (**ΔU**) of the system is a **positive** value if the system:

A) Absorbs heat and work done on it.
B) Absorbs heat and does work.
C) Release heat and does work.
D) Release heat and work done on it.

---

3. Given the following reactions:

$C_3H_{8\,(g)} + 5O_{2\,(g)} \rightarrow 3CO_{2\,(g)} + 4H_2O_{(g)}$ $\Delta H = -2043$ kJ
$C_{(gr)} + O_{2\,(g)} \rightarrow CO_{2\,(g)}$ $\Delta H = -394$ kJ
$H_{2\,(g)} + \frac{1}{2}O_{2\,(g)} \rightarrow H_2O_{(g)}$ $\Delta H = -242$ kJ

Find ΔH_{rxn} (in **kJ**) for: $3C_{(gr)} + 4H_{2\,(g)} \rightarrow C_3H_{8\,(g)}$

A) -99 B) -132 C) -118 D) -107

---

4. The amount of heat (in **J**) required to increase the temperature of 350.0 g of copper from 25°C to 85°C is: (the specific heat of copper is 0.385 J/g °C)

A) 6485 B) 8085 C) 7676 D) 6806

---

5. A gas absorbs 1900 J as heat and its change in the internal energy is 1100 J. The amount of work (in **J**) in this process, is:

A) -3000 B) +3000 C) -800 D) +800

---

6. What is the vant Hoff factor of a solution, contained 10.0 g of $CaCl_2$ (an electrolyte) in 100.0 g of water, and the solution freeze at - 4.1 °C? (K_f of water =1.86 °C/m).

A) 2.44 B) 2.85 C) 2.68 D) 2.59

---

7. If 20.0 g of non-electrolyte substance ($M_{wt} = 6.8\times10^4$ g/mol) dissolved in water to make 200 mL of solution. What is the osmotic pressure (in **torr**) at 30 °C?

A) 15.0 B) 9.0 C) 28.0 D) 31.0

---

8. What is the vapor pressure (in **torr**) of a solution prepared from 200.0 g of "$CO(NH_2)_2$ " and 350.0 g of water at 32.0 °C.
(The vapor pressure of pure water at 32.0 °C is 35.7 torr)

A) 28.6 B) 30.5 C) 29.4 D) 27.3

9. The solubility of nitrogen gas "N_2" in water at 20 °C and 520 torr is 5.0×10^{-4} mol/L. The Henry's law constant (in mol/L.atm) at 20 °C, is:

A) $7.3\text{x}10^{-4}$ B) $6.7\text{x}10^{-4}$ C) $6.9\text{x}10^{-4}$ D) $7.1\text{x}10^{-4}$

---

10. What is the freezing point of an aqueous solution, containing a nonvolatile nonelectrolyte solute. The solution has a boiling point of 103.8 °C?
(K_f of water = 1.86 °C/m and K_b of water = 0.52 °C/m)

A) -7.7 °C B) -13.6 °C C) -11.2 °C D) -9.8 °C

---

11. The rate law of a reaction is: rate = $k[A]^{1/2}[B]$. The unit of k (rate constant) is:

A) $M^{-1/2}.\ s^{-1}$ B) $M^{3/2}.\ s$ C) $M^{-3/2}.\ s^{-1}$ D) $M^{1/2}.\ s$

---

12. A ⟶ B is a first order reaction has a rate constant of $7.5\times10^{-3}\ s^{-1}$. The time (in **seconds**) required for the reaction to be 60% complete is:

A) 112 B) 118 C) 122 D) 115

---

13. For the reaction: 3A ⟶ 2B
The average rate of appearance of B may be expressed as:

A) $-\frac{3}{2}\Delta A/\Delta t$ B) $-\frac{2}{3}\Delta A/\Delta t$ C) $+\frac{2}{3}\Delta A/\Delta t$ D) $+\frac{3}{2}\Delta A/\Delta t$

---

14. The rate constant for first order reaction at 700 K is 6.2×10^{-4} and at 760 K is 2.4×10^{-2}. The activation energy (in **kJ/mol**) for this reaction is:

A) 269.5 B) 465.8 C) 325.6 D) 312.7

---

15. For the following reaction:

$$2NO + Cl_2 \longrightarrow 2NOCl$$

The table shows the initial rates of the reaction that measured for three experiments:

Exp.	$[NO]_o$ mol/L	$[Cl_2]_o$ mol/L	Initial rate (mol L^{-1} hr^{-1})
1	0.50	0.50	1.19
2	1.0	0.50	4.76
3	1.0	1	9.52

The rate law for the reaction is:

A) rate = $k\ [Cl_2]^2$ B) rate = $k\ [NO]^2[Cl_2]$

C) rate = $k\ [NO][Cl_2]^2$ D) rate = k
