

Name: _____
first (print)
family (print)

Test no 2
 Tuesday, April 21, 2026
 Room: 4H.12, 12:00 h



**PLEASE turn off
your cell phone**

Instructions:

1. The duration of the exam is 75 minutes.
2. No extra books or paper may be used.
3. Make sure that there are no pages missing: total of 8 pages.
4. A Periodic Table of the Elements with constants has been provided.
5. Answers must be submitted in ink in order to preserve the right to grieve.
6. In order to receive full credit for your answer, your work must be shown.
7. Calculators may not be shared. Programmable calculators are not allowed.
8. Your attention is drawn to the college policy on cheating. This policy will be enforced.
9. Check you numbers twice. A calculator never does mistake, it just calculate the numbers input by the operator. If the number of digits is insufficient throughout the calculation, which gives a result different from the expected one, it will be considered as a calculation error.

For each math error or bad number transcript: -1 mark.

for questions involving calculations, write your final answer in ink in the appropriate space

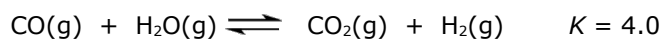
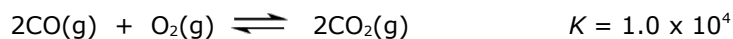
Question 1 : / 6	Question 4 : / 4	Question 7 : / 7
Question 2 : / 7	Question 5 : / 8	Question 8 : / 5
Question 3 : / 6	Question 6 : / 7	

Total : / 50

Note: All pH problem of this exam are at 25 °C therefore, consider $K_w = 1.00 \times 10^{-14}$

Question 1

a. Calculate the equilibrium constant for: $2\text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{O}_2(\text{g}) + 2\text{H}_2(\text{g})$ at 25 °C using the following two equilibrium. (3 marks)



answer: _____

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Match each of the following "equilibrium condition" for a system, with one of the available answers. (note: the same answer can be used more than once) (3 marks)

Equilibrium condition	Possible answer
b. $Q < K$	i) Reaction is at equilibrium.
c. $K \approx 1$	ii) Reaction will favour formation of reactants
d. $Q = K$	iii) Reaction favours formation of more product
	iv) Reaction does not strongly favour reactants or products

answers: b. _____ c. _____ d. _____

Question 2

Consider the following equilibrium for the production of hydrogen gas from water:



100.0 g of water and 50.0 g of solid carbon are heated together (to 500.0 °C) in a 10.0 L container; calculate the mass of hydrogen gas produced once the equilibrium is reached. (4 marks)

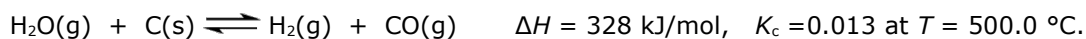
answer: _____

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g. What is the K_p value for this reaction at 500.0 °C? (3 marks)

answer: _____

Question 3

Consider the same reaction as the one of the previous problem ($T = 500\text{ }^{\circ}\text{C}$, $K_c = 77$): (6 marks)



Predict qualitatively the change of concentration of $\text{CO}(\text{g})$ after the following changes of conditions.

	CO(g) amount (number of mole)		
	decreases	no change	increases
a. $\text{CO}_2(\text{g})$ is added to increase the pressure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Some $\text{H}_2\text{O}(\text{g})$ condenses to form $\text{H}_2\text{O}(\ell)$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Increasing the size of the container	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. the reaction is heated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. removing some $\text{C}(\text{s})$ from the reaction mixture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. A catalyst is added	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question 4

a. Which of the following strong acid aqueous solution has a pH of 2.22 (1 mark)

- i) 0.25 g HI (130.6 g/mol) dissolved in 250 mL water
- ii) 25 mL of 0.036 M HNO_3 added to 125 mL water
- iii) 0.0050 mol of HClO_4 dissolved in 750 mL water
- iv) none of the above

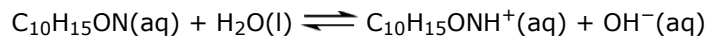
answer: _____

b. What mass of KOH is necessary to prepare 750.0 mL of a solution having pH = 12.22? (3 marks)

answer: _____

Question 5

- a. Ephedrine, a central nervous system stimulant, is used in nasal sprays as a decongestant. This compound is a weak organic base:



A 0.0350 M solution of ephedrine has a pH of 11.33. Calculate K_b for ephedrine. (4 marks)

answer: _____ (correct answer with 2 s.f.)

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- b. Consider a mixture of 0.0100 M HCl and 0.255 M acetic acid, HCH_3COO . Calculate the concentration of the acetate ion (CH_3COO^-) in this solution at equilibrium. (4 marks)

answer: _____

Question 8

Calculate the pH of the buffer obtained from the reaction of 55.0 mL of 0.0470 mol/L HCl with 245 mL of 0.0264 mol/L CH₃NH₂ (methylamine, $K_b = 4.40 \times 10^{-4}$) (5 marks)

answer: _____ (correct with 3 s.f. after the dot)