

IMPORTANT

USE NO. 2 PENCIL ONLY

EXAMPLE: ☐ A ☐ B ☐ C ☐ D ☐ E

ERASE COMPLETELY TO CHANGE

NAME KEY SA 2003

SUBJECT _____

DATE _____ HOUR _____

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TEST RECORD

PART 1

PART 2

TOTAL

	(T) 1	(F) 2	3	KEY 5
1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
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44	A	B	C	D
45	A	B	C	D
46	A	B	C	D
47	A	B	C	D
48	A	B	C	D
49	A	B	C	D
50	A	B	C	D

FEED THIS DIRECTION

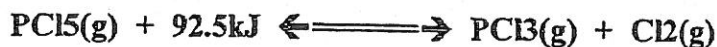
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18.

Consider the following equilibrium:



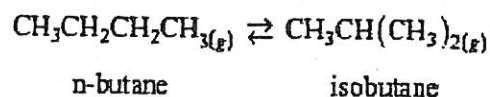
Which change will cause the equilibrium to shift to the right?

- A. add some Cl_2
- B. add a suitable catalyst
- C. decrease the temperature
- ☒ D. increase the volume of the container

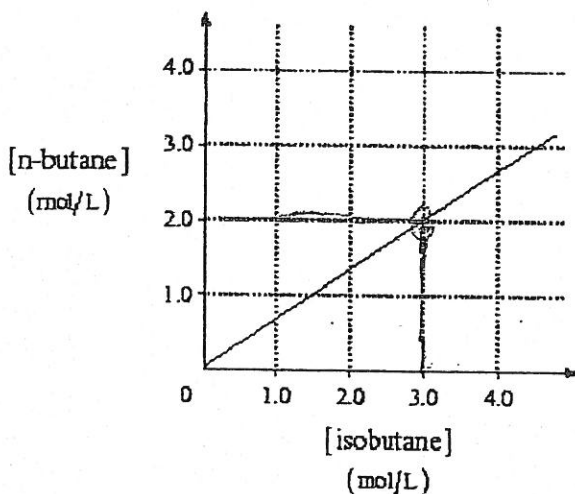
Part II: Written Section: - show all calculations leading to the correct solution
(Sig. Dig's count)

19.

Consider the graph below representing the following equilibrium:



Data for the graph was obtained from various equilibrium mixtures.



Calculate the value of K_{eq} for the equilibrium.

(2 marks)

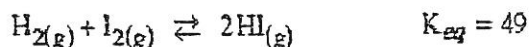
$$K_{eq} = \frac{[\text{Isobutane}]}{[\text{n-butane}]}$$

$$K_{eq} = \frac{3}{2}$$

$$K_{eq} = 1.5$$

20.

Consider the following equilibrium:



A 1.00 L container is initially filled with 0.180 mol HI.
Calculate the concentration of HI at equilibrium.

(4 marks)

$$\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$$

I	0	0	0.180
C	+x	+x	-2x
E	x	x	0.180-2x

$$K_{eq} = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]}$$

$$\sqrt{49} = \sqrt{\frac{(0.180-2x)^2}{x^2}}$$

$$7 = \frac{0.180-2x}{x}$$

$$7x = 0.180 - 2x$$

$$9x = 0.180$$

$$x = 0.02 \text{ M}$$

21.

Reactants A and B are mixed in a closed container, each at a concentration of 0.75M. They react slowly producing species C and D:



At equilibrium [D] = 0.55M. Determine K_{eq} (3 marks)

$$\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$$

I	0.75	0.75	0	0
C	-0.55	-0.55	+0.55	+0.55
E	0.20	0.20	0.55	0.55

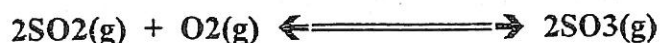
$$K_{eq} = \frac{[\text{C}][\text{D}]}{[\text{A}][\text{B}]}$$

$$K_{eq} = \frac{(0.55)^2}{(0.20)^2}$$

$$\therefore [\text{HI}] = 0.180 - 0.04 = 0.14 \text{ M}$$

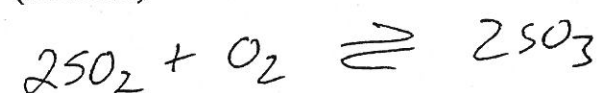
22.

$K_{eq} = 3.1$ at a certain temperature for the following system:



If a 2.0L bulb were filled with 1.2 mol SO_3 , 0.7 mol SO_2 and 1.6 mol of O_2 , indicate the equilibrium shift (if any) which will occur and explain your answer in terms of K_{eq} .

(3 marks)



$$K_{\text{trial}} = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]}$$

$$K_{\text{trial}} = \frac{(0.60)^2}{(0.35)^2 (0.80)}$$

$$K_{\text{trial}} = 3.7 > K_{eq}$$

$\therefore$ Shift left.

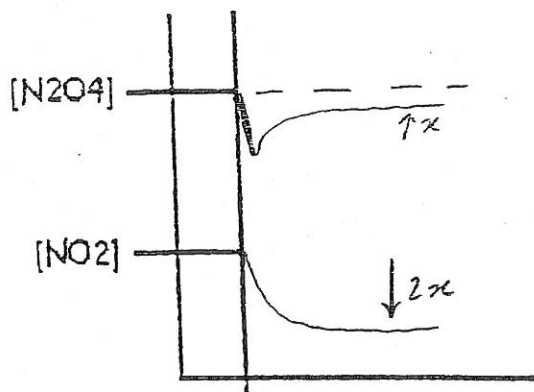
Part III: Graphing equilibrium shifts (the diagrams are on the next page).

23. Consider the following equilibrium system:

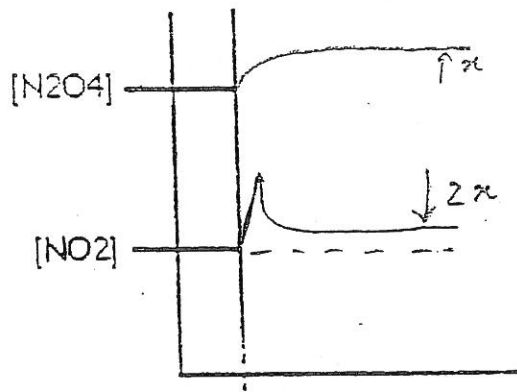


You are to draw a general graph indicating relative concentration changes for each of the following stresses placed on this equilibrium (1 mark/graph).

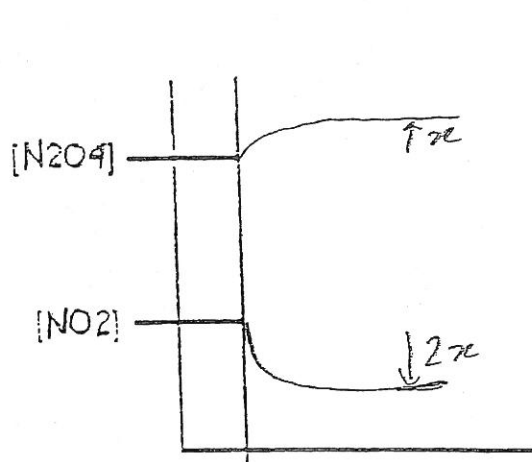
- Rapid removal of $\text{N}_2\text{O}_4(\text{g})$
- Inject $\text{NO}_2(\text{g})$
- Increase the temperature of the system
- Decrease the volume of the container
- Increase the pressure of the system by injecting $\text{Ar}(\text{g})$



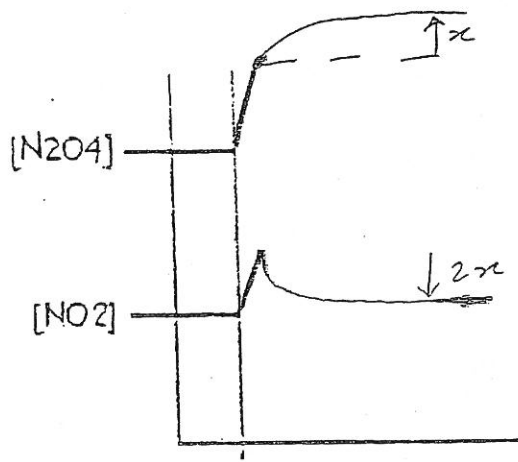
Stress: A



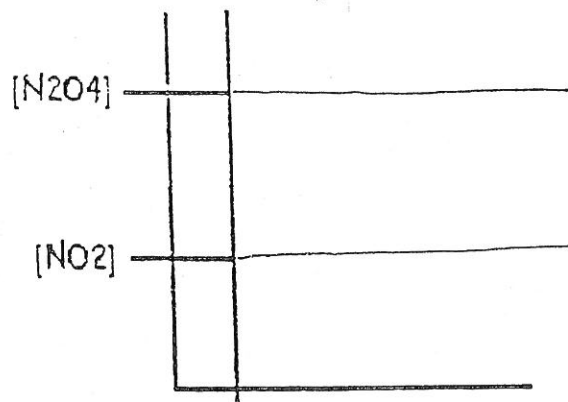
Stress: B



Stress: C



Stress: D



Stress: E