Trinity College

IN NOMINE DOMINI

CHEMISTRY

NAME : SOLNS

TOPIC : Equilibrium test 2018

Please indicate your answer with a cross (X) within the box.

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**
8	A	B	**C**	D
9	A	B	C	**D**
10	A	B	**C**	D
11	**A**	B	C	D
12	A	**B**	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D

Trinity College

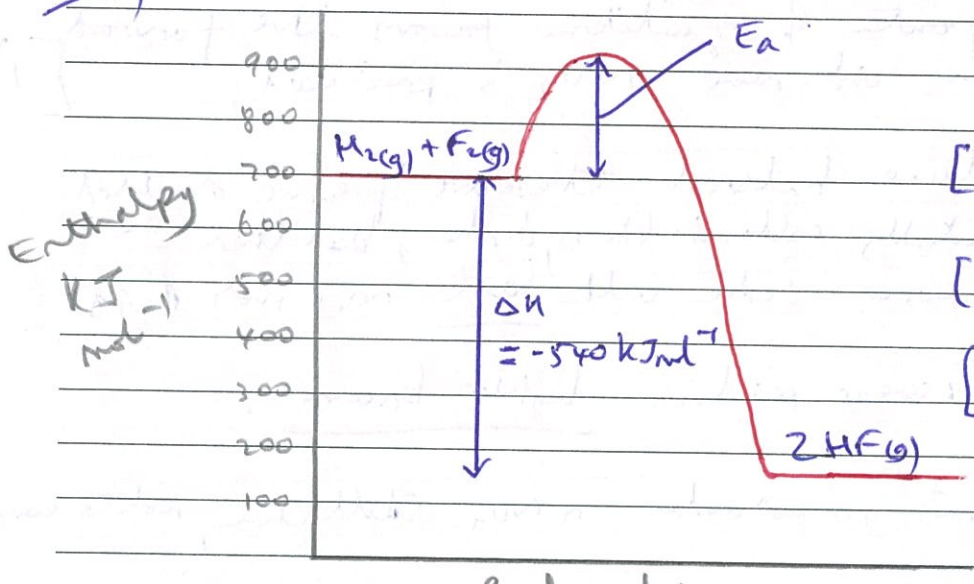
ATAR Chemistry

Answer Booklet

Test: Equilibrium 2018 Name: Soln

52 mark

1 a)

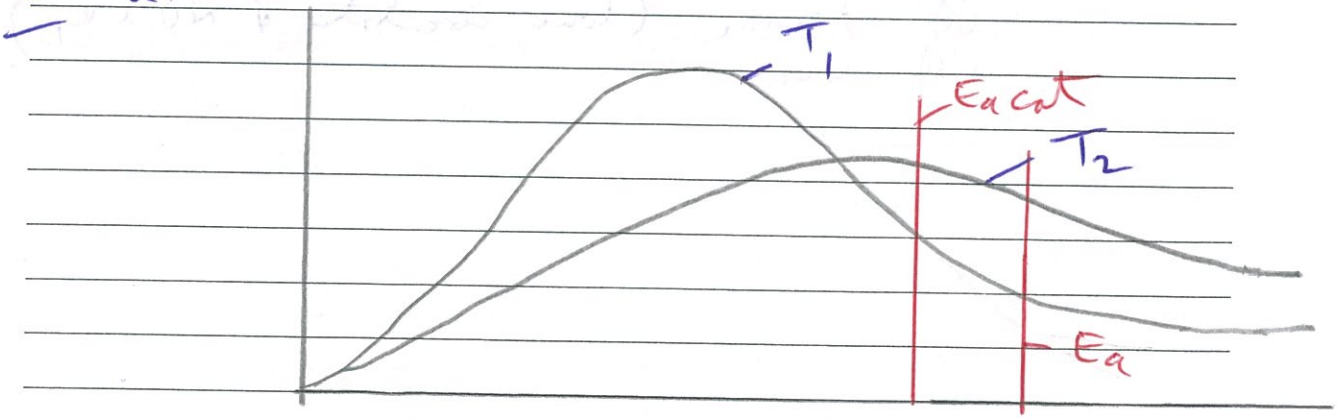


[1] graph correct shape & values,
[1] products & reactant
[1] ΔH - ve
[1] Ea.

-1 mins if axis incorrect

b) exothermic [1]

2 a)



T_2 - flatter & to right of T_1

$E_{a\,cat}$ - to left of E_a. [2]

$N_2O_4 \rightleftharpoons 2NO_2 \quad \Delta H = +58kJ$
colourless brown

3

a) Endothermic → darker brown [1]

b) Heat is added to the system - imposed change.
According to Le Chatelier's Principle the system will partially offset the imposed change [1]
by favouring the endothermic reaction.
The position of equilibrium favours the forward reaction and more NO_2 is produced. [1]

c) Volume halved therefore pressure doubled
Initially colliding more, darker, but then ⇒
favour side with least no. of moles of gas.

reverse reaction lighter brown.

Does not go colourless as NO_2 still there, not to completion

4

a) i) decrease
ii) increase
iii) same

b) i) increase
ii) decrease (lower concentration of NO & O_2).
iii) increase.

5. a. i. If the pressure of the system is increased, then the equilibrium will shift in such a direction so as to produce fewer particles and thus reduced the pressure. In this case, the equilibrium position will SHIFT to the RIGHT which has less gas particles. The partial pressure (concentration) of the SO_3 will increase, and the partial pressures of the SO_2 and O_2 will decrease. [2]

ii. If the temperature of the system is increased, initially the kinetic energy of both the products and reactants will increase as will the forward and reverse reactions. According to LCP the reaction will shift in such a way to partially offset the rise in temperature. In this case, the reaction is exothermic in the forward direction, so the position of equilibrium will SHIFT to the LEFT to counteract the imposed change. The partial pressure of the SO_3 will decrease, and the partial pressures (concentrations) of the SO_2 and O_2 will increase. [2]

iii. If the volume of the system is increased, then the pressures of all gases present will drop. According to LCP the equilibrium will shift in such a way so as to produce more particles and increase the pressure. There are more particles on the left hand side so the position of equilibrium will SHIFT to the LEFT. The partial pressure (concentration) of the SO_3 will decrease, and the partial pressures of the SO_2 and O_2 will increase. [2]

iv. Adding a catalyst will have no effect whatsoever on the position of equilibrium or the concentration of all the substances. [2]

b. i. No change
ii. K decreases
iii. No change
iv. No change

[½ each]

6. a. i. Decrease pressure → DECREASE YIELD
ii. Decrease temperature → INCREASE YIELD
iii. Catalyst → NO EFFECT ON YIELD

[1 each]

b. i. Increase pressure → INCREASE RATE OF ATTAINMENT
ii. Increase temperature → INCREASE RATE OF ATTAINMENT
iii. Removing Catalyst → DECREASE RATE OF ATTAINMENT

7. a. Only $POCl_3$
b. Equilibrium - concentration of product & reactants constant.
c. Chlorine (Cl_2) removed from mixture.
d. Volume of reaction vessel was reduced.
e. Equilibrium shifted LEFT to produce more $POCl_3$ reactant.
f. Graph will not change.
If system at equilibrium catalyst has no effect.
Catalyst only reduces time to get to equilibrium.