

Higher Unit 3 Part 1 – Tutorial Sheet

Please attempt the following questions in preparation for the online session on 23rd January.



How many litres of nitrogen dioxide gas could theoretically be obtained in the reaction of 1 litre of nitrogen monoxide gas with 2 litres of oxygen gas?

(All volumes are measured under the same conditions of temperature and pressure.)

- A. 1
- B. 2
- C. 3
- D. 4

(1)

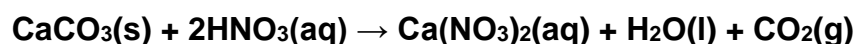
2. A few drops of concentrated sulfuric acid were added to a mixture of 0.1 mol of methanol and 0.2 mol of ethanoic acid. Even after a considerable time, the reaction mixture was found to contain some of each reactant.

Which of the following is the best explanation for the incomplete reaction?

- A. The temperature was too low.
- B. An equilibrium mixture was formed.
- C. Insufficient methanol was used.
- D. Insufficient ethanoic acid was used.

(1)

3. Calcium carbonate reacts with nitric acid as follows.



0.05 mol of calcium carbonate was added to a solution containing 0.08 mol of nitric acid.

Which of the following statements is true?

- A. 0.05 mol of carbon dioxide is produced.
- B. 0.08 mol of calcium nitrate is produced.
- C. Calcium carbonate is in excess by 0.01 mol.
- D. Nitric acid is in excess by 0.03 mol.

(1)

4. Which line in the table applies correctly to the use of a catalyst in a chemical reaction?

	Position of equilibrium	Effect on value of ΔH
A.	Moved to right	Decreased
B.	Unaffected	Increased
C.	Moved to left	Unaffected
D.	Unaffected	Unaffected

(1)

5. A mixture of magnesium bromide and magnesium sulfate is known to contain 3 mol of magnesium and 4 mol of bromide ions.

How many moles of sulfate ions are present?

- A. 1
- B. 2
- C. 3
- D. 4

(1)

6. In which of the following would an increase in pressure result in the equilibrium position being moved to the left?

- A. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$
- B. $\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g})$
- C. $\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g})$
- D. $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{CO}(\text{g}) \rightleftharpoons 2\text{Fe}(\text{s}) + 3\text{CO}_2(\text{g})$

(1)

7. Which of the following gases has the same volume as 128.2g of sulfur dioxide?
(All volumes are measured under the same conditions of temperature and pressure)

- A. 2.0 g hydrogen
- B. 8.0 g helium
- C. 32.0 g oxygen
- D. 80.8 g of neon.

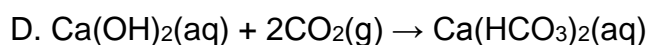
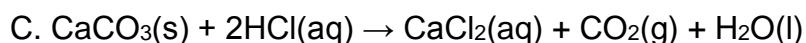
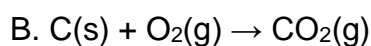
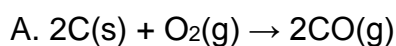
(1)

8. Which line in the table describes dynamic equilibrium?

	Concentration of reactants and products	Forward and reverse reaction rates
A.	constant	equal
B.	constant	not equal
C.	not constant	equal
D.	not constant	not equal

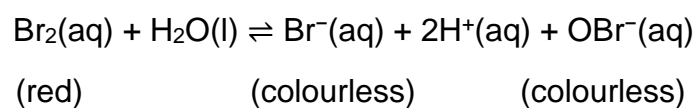
(1)

9. In which of the following reactions would the products have a lower volume than the reactants?



(1)

10. The following equilibrium exists in bromine water.



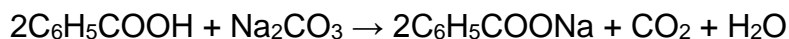
The red colour of bromine water would fade on adding a few drops of a concentrated solution of



(1)

11. Sodium benzoate is used in the food industry as a preservative.

It can be made by reacting benzoic acid with a concentrated solution of sodium carbonate.



mass of	mass of	mass of	mass of	mass of
one mole	one mole	one mole	one mole	one mole
= 122 g	= 106 g	= 144 g	= 44 g	= 18 g

Calculate the atom economy for the production of sodium benzoate.

(2)

12. In the lab, methanamide can be prepared by the reaction of methanoic acid with ammonia.

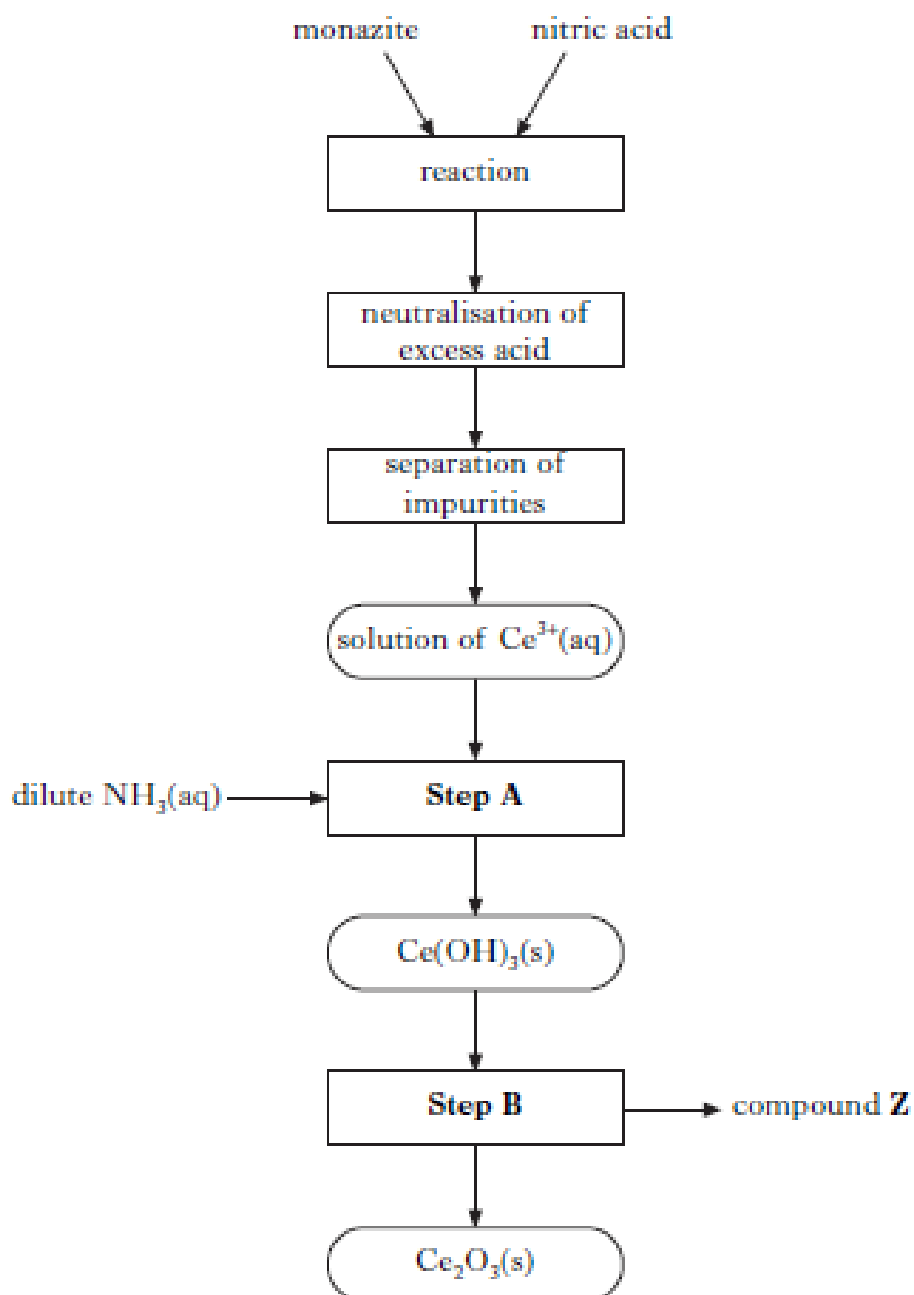
HCOOH	+	NH ₃	⇌	HCONH ₂	+	H ₂ O
mass of		mass of		mass of		mass of
one mole		one mole		one mole		one mole
= 46 g		= 17 g		= 45 g		= 18 g

When 1.38 g of methanoic acid was reacted with excess ammonia, 0.945 g of methanamide was produced.

Calculate the percentage yield of methanamide.

(2)

13. Cerium metal is extracted from the mineral monazite.
The flow diagram for the extraction of cerium from the mineral is shown.



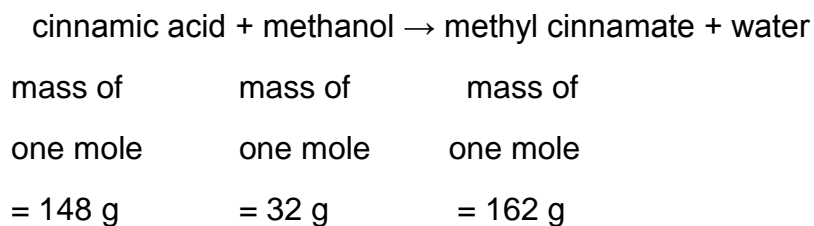
(a) Name the type of chemical reaction taking place in Step A.

(1)

(b) Name the type of chemical reaction taking place in Step A.

(1)

14. A student prepared a sample of methyl cinnamate from cinnamic acid and methanol.

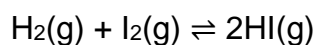


6.5 g of cinnamic acid was reacted with 2.0 g of methanol.

Show, by calculation, that cinnamic acid is the limiting reactant.

(2)

15. The reaction to produce hydrogen iodide is exothermic.



(a) State the effect of increasing temperature on the position of equilibrium.

(1)

(b) State why changing the pressure has no effect on this equilibrium reaction.

(1)

Total marks = 20