

## PolyU SCIENCE Young Talents Competition

### Chemistry - Sample Questions

1. Tests were performed on an aqueous solution of an unknown compound, **R**. The observations are recorded as following:

Test	Observation
Ammonia solution was added	Blue precipitate, soluble in excess ammonia giving a deep blue solution
Dilute nitric acid was added at first, and then barium nitrate solution was added	White precipitate
Dilute nitric acid was added at first, and then silver nitrate solution was added	No precipitate

Which ions are present in **R**?

- A)  $\text{Cu}^{2+}$  and  $\text{SO}_4^{2-}$   
B)  $\text{Cu}^{2+}$  and  $\text{Cl}^-$   
C)  $\text{Fe}^{2+}$  and  $\text{Cl}^-$   
D)  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$
2. The table below shows the standard enthalpy changes of combustion of four hydrocarbons, namely ethyne, propyne, propene and propane.

Name	Relative molecular mass	$DH_c^\theta$ (kJ/mol)
ethyne	26.0	-1,305
propyne	40.0	-1,940
propene	42.0	-2,060
propane	44.0	-2,200

Complete combustion of 1.00 g of one of the above hydrocarbons releases exactly 40 kJ, if the combustion efficiency only 80%. The hydrocarbon is

- A) ethyne  
B) propyne  
C) propene  
D) propane

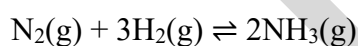
3. Which of the following statements concerning the following reaction is/are correct?



- (1)  $\text{H}^+(\text{aq})$  is an oxidizing agent in the reaction.
- (2)  $\text{HMnO}_4^-(\text{aq})$  is an oxidizing agent in the reaction.
- (3)  $\text{HMnO}_4^-(\text{aq})$  is a reducing agent in the reaction.

- A) (1) only
- B) (2) only
- C) (1) and (3) only
- D) (2) and (3) only

4. Consider the following reaction:



A mixture of nitrogen (2.00 moles), hydrogen (6.00 moles) and ammonia (2.40 moles) is allowed to reach an equilibrium in a sealed  $1 \text{ dm}^3$  vessel. It was found that 2.32 moles of nitrogen were present in the equilibrium mixture. What is the value of  $K_c$ ?

- A)  $3.96 \times 10^{-3}$
- B)  $5.29 \times 10^{-3}$
- C)  $7.39 \times 10^{-3}$
- D)  $1.15 \times 10^{-2}$