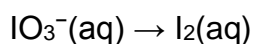


**Higher Unit 3 Part 2 – Tutorial Sheet**

Please attempt the following questions in preparation for the session on 13<sup>th</sup> March.

1. During a redox process in acid solution, iodate ions,  $\text{IO}_3^-(\text{aq})$ , are converted into iodine,  $\text{I}_2(\text{aq})$ .

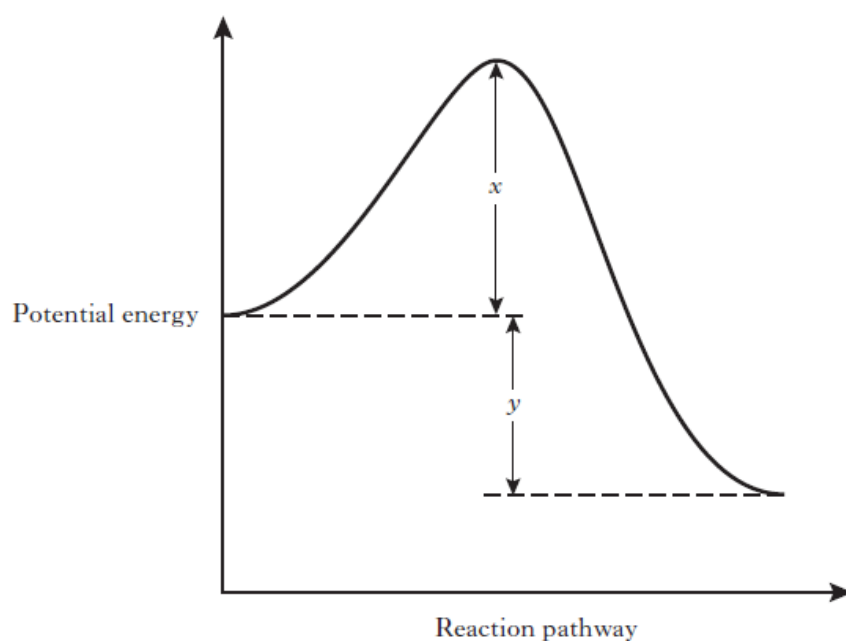


The numbers of  $\text{H}^+(\text{aq})$  and  $\text{H}_2\text{O}(\text{l})$  required to balance the ion-electron equation for the formation of 1 mol of  $\text{I}_2(\text{aq})$  are, respectively

- A. 3 and 6
- B. 6 and 3
- C. 6 and 12
- D. 12 and 6.

(1)

2.

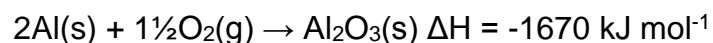


The enthalpy change for the forward reaction can be represented by

- A. x
- B. y
- C. x + y
- D. x - y

(1)

3. Aluminium reacts with oxygen to form aluminium oxide.



What is the enthalpy of combustion of aluminium in  $\text{kJ mol}^{-1}$ ?

- A. -835
- B. -1113
- C. -1670
- D. +1670

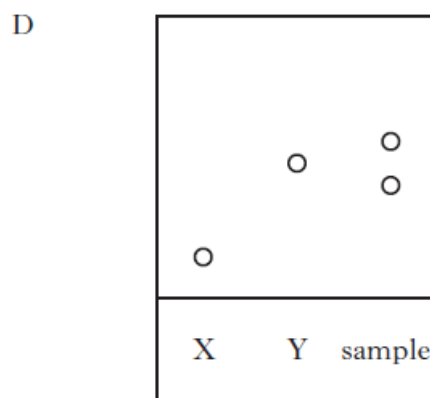
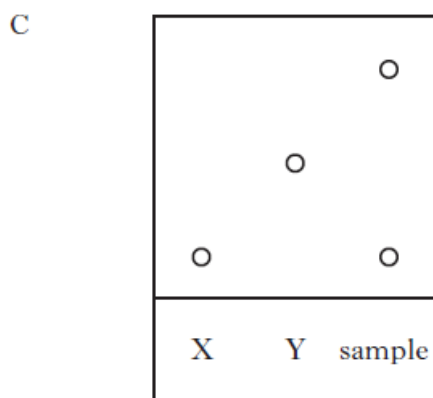
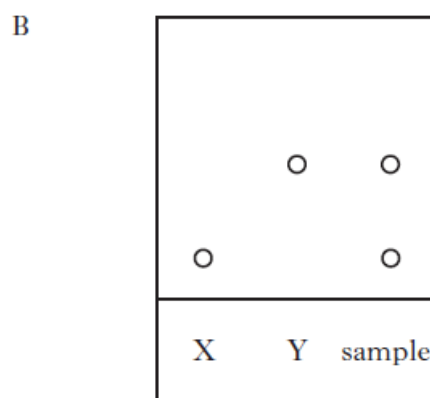
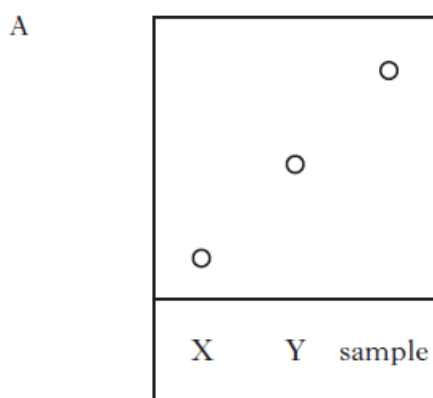
(1)

4. An organic chemist is attempting to synthesise a fragrance compound by the following chemical reaction.



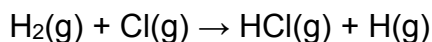
After one hour, a sample is removed and compared with pure samples of compounds X and Y using thin-layer chromatography.

Which of the following chromatograms shows that the reaction has produced a pure sample of the fragrance compound?



(1)

5. In the presence of bright light, hydrogen and chlorine react explosively. One step in the reaction is shown below.



The enthalpy change for this step can be represented as

- A. (H-H bond enthalpy) + (Cl-Cl bond enthalpy)
- B. (H-H bond enthalpy) – (Cl-Cl bond enthalpy)
- C. (H-H bond enthalpy) + (H-Cl bond enthalpy)
- D. (H-H bond enthalpy) – (H-Cl bond enthalpy).

(1)

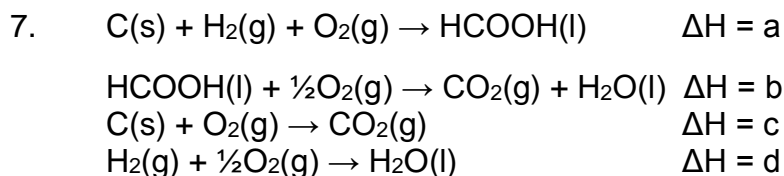
6. The alcohol content of wine was analysed by four students. Each student carried out the experiment three times.

	Experiment 1 / %	Experiment 2 / %	Experiment 3 / %
Student A	10.0	9.0	8.0
Student B	6.4	6.6	6.8
Student C	6.5	6.6	6.6
Student D	9.0	8.5	8.6

The most reproducible results were obtained by

- A. Student A
- B. Student B
- C. Student C
- D. Student D.

(1)



What is the relationship between a, b, c and d?

- A.  $a = c + d - b$
- B.  $a = b - c - d$
- C.  $a = -b - c - d$
- D.  $a = c + b + d$

(1)

8. Which of the following elements is the strongest reducing agent?

- A. Fluorine
- B. Bromine
- C. Lithium
- D. Aluminium

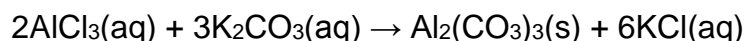
(1)

9. 45cm<sup>3</sup> of a solution could be most accurately measured out using a

- A. 50 cm<sup>3</sup> beaker
- B. 50 cm<sup>3</sup> burette
- C. 50 cm<sup>3</sup> pipette
- D. 50 cm<sup>3</sup> measuring cylinder.

(1)

10. Aluminium carbonate can be produced by the following reaction.



The most suitable method for obtaining a sample of the aluminium carbonate is

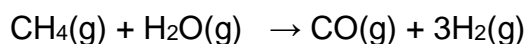
- A. collection over water
- B. distillation
- C. evaporation
- D. filtration.

(1)

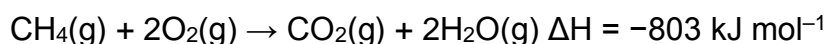
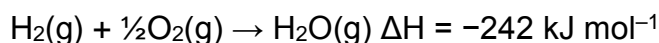
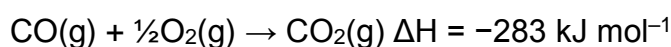
11. Mobile phones are being developed that can be powered by methanol.

Methanol can be made by a two-stage process.

In the first stage, methane is reacted with steam to produce a mixture of carbon monoxide and hydrogen.



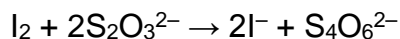
Use the data below to calculate the enthalpy change, in kJ mol<sup>-1</sup>, for the reaction.



(2)

12. Solutions containing iodine are used to treat foot rot in sheep.

The concentration of iodine in a solution can be determined by titrating with a solution of thiosulfate ions.



thiosulfate  
ions

(a) Write an ion-electron equation for the reaction of the oxidising agent in the titration. (1)

(b) Three 20.0 cm<sup>3</sup> samples of a sheep treatment solution were titrated with 0.10 mol l<sup>-1</sup> thiosulfate solution.

The results are shown below.

Sample	Volume of Thiosulfate Solution / cm <sup>3</sup>
1	18.60
2	18.10
3	18.20

Why is the volume of sodium thiosulfate used in the calculation taken to be 18.15 cm<sup>3</sup>, although this is not the average of the three titres in the table? (1)

(c) Calculate the concentration of iodine, in mol l<sup>-1</sup>, in the foot rot treatment solution. **Show your working clearly.** (3)

(d) Describe how to prepare 250 cm<sup>3</sup> of a 0.10 mol l<sup>-1</sup> standard solution of sodium thiosulfate, Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>. Your answer should include the mass, in g, of sodium thiosulfate required. (3)

**Total marks = 20**