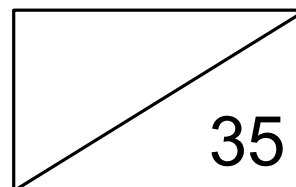


Seb Academy
Chemistry Homework
Topics: Energy of Reaction
Time allowed: 45 min



Date: _____

Name: _____

Energy of Reactions Homework 2

Skill 4 Recall endothermic and exothermic processes

Know that melting, boiling & sublimation are endothermic process

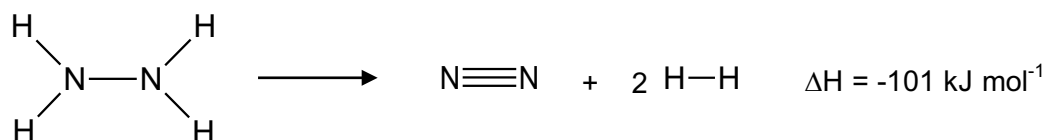
1. State whether the following observations are exothermic or endothermic reaction? [8]

	Chemical reactions	Exothermic or endothermic reaction
(a)	Sweat evaporating from the skin.	
(b)	Melting of ice-cream on a hot day.	
(c)	Solid iodine sublimes into iodine vapour	
(d)	Aqueous sodium hydroxide is neutralized by dilute nitric acid.	
(e)	A mixture of hydrogen and oxygen explodes with a 'pop' sound.	
(f)	Magnesium on burning gives a brilliant white flame.	
(g)	In an explosive thermite reaction of aluminium and iron (III) oxide are heated together, the reaction mixture glowed red-hot	
(h)	During photosynthesis , carbon dioxide and water reacts together in green plants in the presence of uv/sunlight forming glucose and oxygen.	

[Total: 8 marks]

Skill 6 Explain overall enthalpy changes in terms of the energy changes associated with the breaking and making of covalent bonds

2. (2016/S4RP/FE/3(f)) Hydrazine, N_2H_4 , has been used as a propellant in rockets. On ignition according to the equation below, N_2H_4 will form nitrogen and hydrogen gas very rapidly and exothermically.



- (a) Use ideas about bond breaking and bond making to explain why the above reaction is exothermic. [2]

Bond breaking is _____ and bond forming is _____.

The reaction is exothermic because the energy _____ in _____

_____ $N \equiv N$ and _____ $H - H$ bonds is _____ than the energy _____ in

_____ $N - N$ and _____ $N - H$ bonds.

[Total: 2 marks]

Skill 7 Effect of catalyst

3. (2017/O/GCSE/5) A student carried out some experiments to investigate the displacement reactions of four metals: She added metals to salt solutions. The table shows her observations.

Metal	Salt solution			
	Copper (II) sulfate	Magnesium sulfate	Cobalt (II) sulfate	Chromium (III) sulfate
Copper		No change. Solution remains colourless	No change, solution remains pink	No change, solution remains green
Magnesium	Brown solid forms in colourless solution		Grey solid forms in colourless solution	Grey solid forms in colourless solution
Cobalt	Brown solid forms in pink solution	No change, solution remains colourless		No change, solution remains green
Chromium	Brown solid forms in green solution	No change, solution remains colourless	Grey solid forms in green solution	

- (a) What is the order of reactivity for the four metals? [1]

Most reactive

Least Reactive

- (b) Given that magnesium sulfate solution is colourless, complete the table to show the colourless of the other metal sulfate solutions. [2]

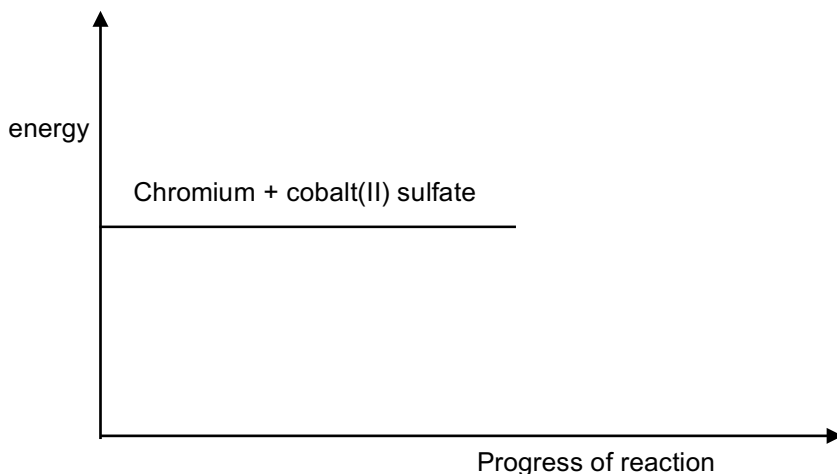
Metal sulfate	Colour
Copper (II) sulfate	
Cobalt (II) sulfate	
Chromium sulfate	

(c) These displacement reactions are exothermic.

i. Complete the energy profile diagram for the reaction between chromium and cobalt (II) sulfate solution. Your diagram should include:

- The names of the products of the reaction.
- Labels to show the enthalpy change of reaction and the activation energy. [3]

ii. Add in a new graph to show the effect of adding a catalyst. [1]



4. Write an ionic equation for the reaction when chromium metal is added to a solution of cobalt (II) sulfate [2]

(a) The student added calcium to separate samples of each of the salt solution. The student observed fizzing. Explain this observation. [1]

[Total: 10 marks]

Skill 8 Energy changes and calculations

5. Ethene, C_2H_4 , undergoes atomisation to form carbon and hydrogen atoms.

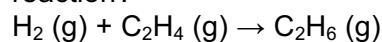


The bond energies are given in the table below.

Bond	Bond energy/ kJ mol ⁻¹
C – C	345
C = C	835
C – H	415
H – H	432

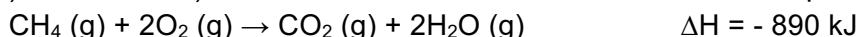
What is the total energy required when 1 mole of ethene undergoes atomisation?

- A** 2005 kJ
B 2073 kJ
C 2495 kJ
D 2563 kJ
6. Ethane can be obtained by adding hydrogen to ethene. What is the enthalpy change of the reaction?



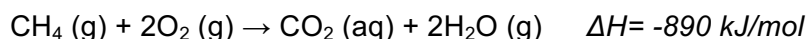
Bond energies (in kJ mol ⁻¹)	H - H	C - C	C = C	C - H
	436	348	614	413

- A** + 142 kJ/mol
B - 42 kJ/mol
C - 124 kJ/mol
D - 142 kJ/mol
7. 2017/GMS(S)/P1/Prelim/30) The combustion of methane is an exothermic process.



How much methane should be used to produce 2670 kJ of heat?

- A** 48g
B 64g
C 96g
D 120g
8. (2015/S4/RP/MYCT/10) The equation for the combustion of methane is shown below.



How much heat is produced when 80 g of methane is completely burnt in oxygen?

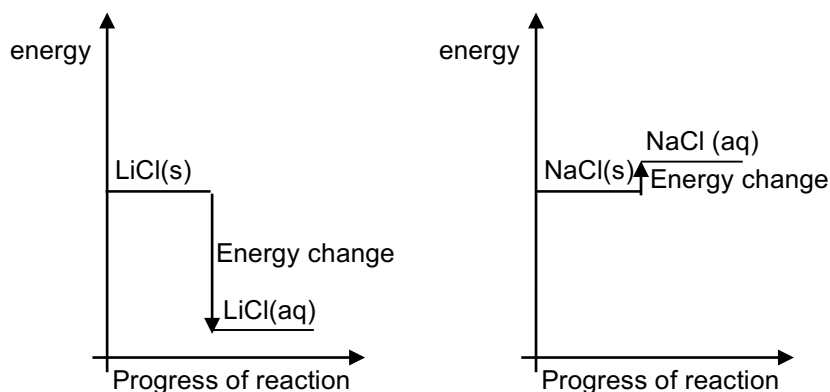
- A** 4450 kJ
B 7120kJ
C 44500kJ
D 71200kJ

9. (2017/SJI/P1/27) The enthalpy of vaporization, (ΔH_{vap}) is the amount of energy absorbed to convert one mole of a liquid substance into a gas. The ΔH_{vap} for water is +40.7 kJ/ mol at 100°C and 1 atm.

Which of the following statements is true?

- A The H_{vap} for water is positive as energy is absorbed to break O-H bonds
- B 226 kJ of heat is absorbed to convert 100g of water into steam at 100°C and 1 atm
- C Less than 226 kJ of heat is absorbed to convert 100g of water at 25°C into steam at 1 atm
- D Energy is absorbed to transform water molecules vibrating in fixed positions into molecules moving randomly at high speeds

10. (2015/O/GCSSE/9) The diagrams show the energy changes when lithium chloride and sodium chloride are dissolved in water.



- (a) Using the information above, describe the differences in the **energy changes** and **temperature changes** that happen as each compound dissolves. [4]

- (b) A student measured the temperature change when 4.0g of potassium chloride was dissolved in excess water. The table shows her results.

Temperature at start/°C	20
Lowest temperature recorded after dissolving/°C	12
Calculate energy change/J	+720

- i. Explain why the calculated energy change includes a plus sign, "+". [1]

- ii. Use the student's results to calculate the enthalpy change when one mole of potassium chloride dissolves in excess water. Give your answer in kJ/mol, to 3 significant figures. [3]

- iii. Describe what happens to the **arrangement** and **movement** of the particles in potassium chloride when it dissolves in water. [2]

[Total: 15 marks]

Revision on metals (no marks)

1. Complete the following equations, and balance them, if there is any reaction at all.

