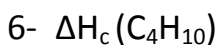
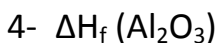
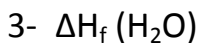
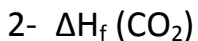
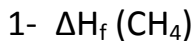


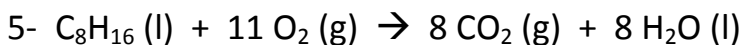
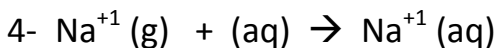
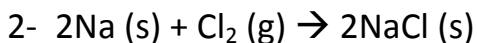
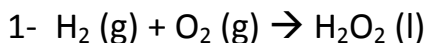
# Worksheet : $\Delta H$ Definitions

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## Write Reaction for the following Enthalpy Changes



## Name the Enthalpy Change for the following Reactions



2 Alcohols such as methanol,  $\text{CH}_3\text{OH}$ , are considered to be possible replacements for fossil fuels because they can be used in car engines.

(a) Define, with the aid of an equation which includes state symbols, the standard enthalpy change of combustion,  $\Delta H_c^\ominus$ , for methanol at 298 K.

equation .....

definition .....

.....

..... [3]

s/12/qp22

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(b) Carbon disulfide is readily combusted to give  $\text{CO}_2$  and  $\text{SO}_2$ .

(i) Construct a balanced equation for the complete combustion of  $\text{CS}_2$ .

.....

(ii) Define the term *standard enthalpy change of combustion*,  $\Delta H_c^\ominus$ .

.....

.....

.....

[3]

s/13/qp23

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3 (a) (i) What is meant by the *standard enthalpy change of formation*,  $\Delta H_f^\ominus$ , of a compound? Explain what is meant by the term *standard*.

.....

.....

.....

(ii) Write an equation, with state symbols, for the  $\Delta H_f^\ominus$  of water.

.....

(iii) Explain why the  $\Delta H_f^\ominus$  for water is identical to the standard enthalpy change of combustion of hydrogen.

.....

..... [4]

w/03/qp2

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- 3 With the prospect that fossil fuels will become increasingly scarce in the future, many compounds are being considered for use in internal combustion engines. One of these is DME or dimethyl ether,  $\text{CH}_3\text{OCH}_3$ . DME is a gas which can be synthesised from methanol. Methanol can be obtained from biomass, such as plant waste from agriculture.

(a) Define, with the aid of an equation which includes state symbols, the standard enthalpy change of combustion,  $\Delta H_c^\ominus$ , for DME at 298 K.

equation .....

definition .....

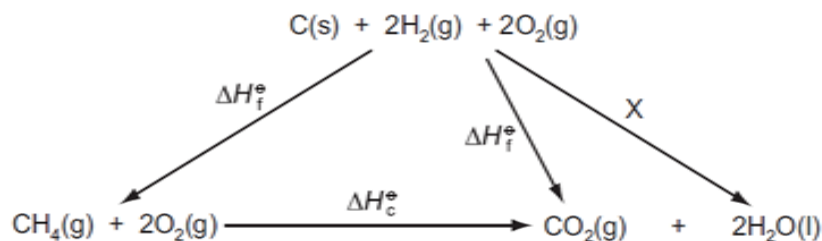
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..... [3]

s/12/qp23

- 3 Enthalpy changes that are difficult to measure directly can often be determined using Hess' Law to construct an enthalpy cycle.

Which enthalpy change is indicated by X in the enthalpy cycle shown?



- A  $-4 \times$  the enthalpy of combustion of hydrogen
- B  $+4 \times$  the enthalpy of combustion of hydrogen
- C  $-2 \times$  the enthalpy of formation of water
- D  $+2 \times$  the enthalpy of formation of water

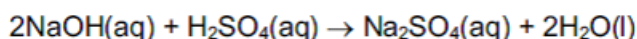
s/14/qp11

- 11 Which energy change corresponds to the enthalpy change of atomisation of hydrogen at 298 K?

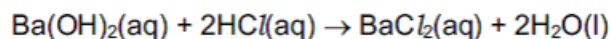
- A the bond energy of a H–H bond
- B half the bond energy of a H–H bond
- C minus half the bond energy of a H–H bond
- D minus the bond energy of a H–H bond

s/13/qp12

10 The enthalpy change of the neutralisation given below is  $-114\text{kJ mol}^{-1}$ .



By using this information, what is the most likely value for the enthalpy change of the following neutralisation?



- A  $-57\text{kJ mol}^{-1}$     B  $-76\text{kJ mol}^{-1}$     C  $-114\text{kJ mol}^{-1}$     D  $-228\text{kJ mol}^{-1}$

w/12/qp13

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5 In the table below,

- '+' means that this type of standard enthalpy change can only have positive values,
- '-' means that this type of standard enthalpy change can only have negative values,
- '+/-' means that either positive or negative values are possible.

Which row is correct?

	atomisation	formation	solution
A	+	+	+/-
B	+	+/-	+/-
C	-	+/-	-
D	-	-	+

w/12/qp11

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11 Which equation represents the change corresponding to the enthalpy change of atomisation of iodine?

- A  $\frac{1}{2}\text{I}_2(\text{g}) \rightarrow \text{I}(\text{g})$   
 B  $\text{I}_2(\text{g}) \rightarrow 2\text{I}(\text{g})$   
 C  $\frac{1}{2}\text{I}_2(\text{s}) \rightarrow \text{I}(\text{g})$   
 D  $\text{I}_2(\text{s}) \rightarrow 2\text{I}(\text{g})$

w/10/qp11

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- 7 The table shows the enthalpy change of neutralisation per mole of water formed,  $\Delta H$ , for various acids and bases.

acid	base	$\Delta H/\text{kJ mol}^{-1}$
hydrochloric acid	sodium hydroxide	-57.0
<b>P</b>	sodium hydroxide	-54.0
hydrochloric acid	<b>Q</b>	-52.0
nitric acid	<b>R</b>	-57.0

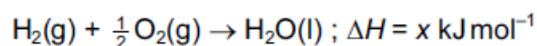
What are **P**, **Q** and **R**?

	<b>P</b>	<b>Q</b>	<b>R</b>
<b>A</b>	ethanoic acid	ammonia	potassium hydroxide
<b>B</b>	ethanoic acid	sodium hydroxide	ammonia
<b>C</b>	sulphuric acid	ammonia	potassium hydroxide
<b>D</b>	sulphuric acid	sodium hydroxide	ammonia

w/05/qp1

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- 3 The equation for a reaction is shown.



Which pair of descriptions is fully correct for this reaction?

	type(s) of enthalpy change	value of $x$
<b>A</b>	formation only	positive
<b>B</b>	formation only	negative
<b>C</b>	combustion, formation	positive
<b>D</b>	combustion, formation	negative

s/12/qp11

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- 8 Which reaction has an enthalpy change equal to the standard enthalpy change of formation of propane?

- A**  $3\text{C}(\text{g}) + 4\text{H}_2(\text{g}) \rightarrow \text{C}_3\text{H}_8(\text{g})$   
**B**  $3\text{C}(\text{g}) + 8\text{H}(\text{g}) \rightarrow \text{C}_3\text{H}_8(\text{g})$   
**C**  $3\text{C}(\text{s}) + 4\text{H}_2(\text{g}) \rightarrow \text{C}_3\text{H}_8(\text{g})$   
**D**  $3\text{C}(\text{s}) + 4\text{H}_2(\text{g}) \rightarrow \text{C}_3\text{H}_8(\text{l})$

s/11/qp12

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