

Energetics

Question Paper

Level	A Level
Subject	Chemistry
Exam Board	AQA
Topic	Physical Chemistry
Sub Topic	Energetics
Booklet	Question Paper
Paper type	Multiple choice

Time Allowed: 14 minutes

Score: /14

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

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Q1. The table below shows data for the four hydrocarbons ethyne, propyne, propene and propane. ΔH_c is the standard enthalpy of combustion of these hydrocarbons.

Compound	Name	M_r	$-\Delta H_c^\ominus / \text{kJ mol}^{-1}$
$\text{HC}\equiv\text{CH}$	ethyne	26	1300
$\text{HC}\equiv\text{CCH}_3$	propyne	40	1940
$\text{H}_2\text{C}=\text{CHCH}_3$	propene	42	2060
$\text{CH}_3\text{CH}_2\text{CH}_3$	propane	44	2220

The complete combustion of 2.0 g of one of the above hydrocarbons releases exactly 100 kJ of heat energy.

This hydrocarbon is

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

(Total 1 mark)

Q2. When 0.10 g of propane was burned the quantity of heat evolved was 5.0 kJ. The enthalpy of combustion of propane in kJ mol^{-1} is

- A -800
- B -1500
- C -2200
- D -2900

(Total 1 mark)

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Q3. This question is about the reaction given below.



Enthalpy data for the reacting species are given in the table below.

Substance	CO(g)	H ₂ O(g)	CO ₂ (g)	H ₂ (g)
$\Delta H_f^\ominus / \text{kJ mol}^{-1}$	-110	-242	-394	0

The standard enthalpy change for this reaction of carbon monoxide and steam is

- A +42 kJ mol⁻¹
- B -42 kJ mol⁻¹
- C +262 kJ mol⁻¹
- D -262 kJ mol⁻¹

(Total 1 mark)

Q4. Use the information below to answer this question.



The standard enthalpy of combustion of butane, in kJ mol⁻¹, is

- A -2880
- B -2590
- C -806
- D -554

(Total 1 mark)

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Q5. Use the information below to answer this question.



The value in kJ mol^{-1} of the enthalpy of thermal dissociation when butane forms propane, hydrogen and carbon is

- A -26.3
- B -17.5
- C +17.5
- C +21.2

(Total 1 mark)

Q6. Use the information below to answer this question.

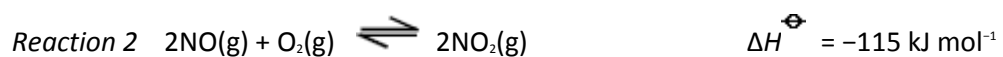
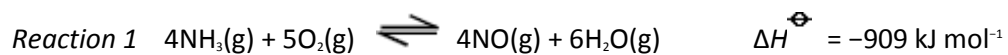


The value in kJ mol^{-1} for the enthalpy of combustion of propane is

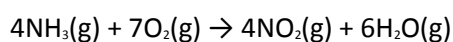
- A -211.7
- B -419.7
- C -2220
- C -2878

(Total 1 mark)

Q7. The data below refer to the industrial production of nitric acid from ammonia.



The direct oxidation of ammonia to nitrogen dioxide can be represented by the equation



for which the standard enthalpy change, in kJ mol^{-1} , is

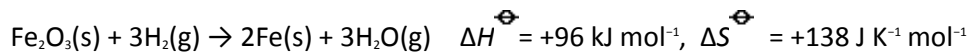
- A -1139
- B -1024
- C -794
- D -679

(Total 1 mark)

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Q8. Using the information below, answer this question.



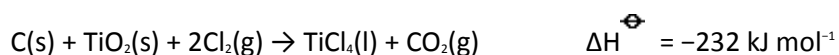
	$\text{Fe}_2\text{O}_3(\text{s})$	$\text{H}_2(\text{g})$	$\text{Fe}(\text{s})$
$\Delta H_f^\ominus / \text{kJ mol}^{-1}$	-822.0	0	0
$\Delta S^\ominus / \text{J K}^{-1} \text{ mol}^{-1}$	90.0	131.0	27.0

The standard enthalpy of formation of steam is

- A +286 kJ mol⁻¹
- B +242 kJ mol⁻¹
- C -242 kJ mol⁻¹
- D -286 kJ mol⁻¹

(Total 1 mark)

Q9. Using the data below, which is the correct value for the standard enthalpy of formation for TiCl₄(l)?



- A -1538 kJ mol⁻¹
- B -1094 kJ mol⁻¹
- C -750 kJ mol⁻¹
- D +286 kJ mol⁻¹

(Total 1 mark)

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Q10. When ethanamide (CH_3CONH_2) burns in oxygen the carbon is converted into carbon dioxide, the hydrogen is converted into water and the nitrogen forms nitrogen gas.

Substance	ethanamide	carbon dioxide	water
Enthalpy of formation (ΔH_f^\ominus) / kJ mol^{-1}	-320	-394	-286

Using the data above, which one of the following is a correct value for the enthalpy of combustion of ethanamide?

- A -1823 kJ mol^{-1}
- B -1183 kJ mol^{-1}
- C -1000 kJ mol^{-1}
- D -360 kJ mol^{-1}

(Total 1 mark)

Q11. In which one of the following reactions is the standard enthalpy change equal to the standard enthalpy of formation of lithium fluoride?

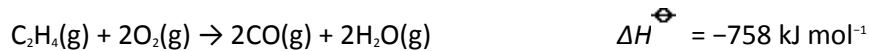
- A $\text{Li(g)} + \text{F(g)} \rightarrow \text{LiF(s)}$
- B $\text{Li}^+(\text{g}) + \text{F}^-(\text{g}) \rightarrow \text{LiF(s)}$
- C $\text{Li}^+(\text{aq}) + \text{F}^-(\text{g}) \rightarrow \text{LiF(s)}$
- D $\text{Li(s)} + \frac{1}{2}\text{F}_2(\text{g}) \rightarrow \text{LiF(s)}$

(Total 1 mark)

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Q12. Consider the reactions

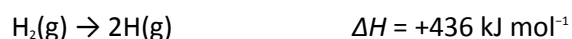


The enthalpy of formation of carbon monoxide is

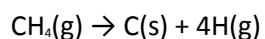
- A -111 kJ mol^{-1}
- B -163 kJ mol^{-1}
- C -222 kJ mol^{-1}
- D -464 kJ mol^{-1}

(Total 1 mark)

Q13. Given the following data



which one of the following is the enthalpy change, in kJ mol^{-1} , of the reaction below?



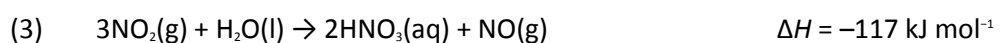
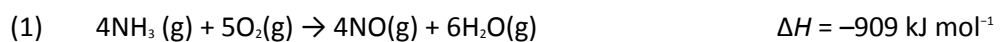
- A -947
- B $+511$
- C $+797$
- D $+947$

(Total 1 mark)

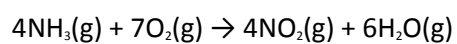
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Q14. Nitric acid is produced industrially from ammonia, air and water using the following sequence of reactions:



Which is the enthalpy change (in kJ mol^{-1}) for the following reaction?



- A -679
- B -794
- C -1024
- D -1139

(Total 1 mark)