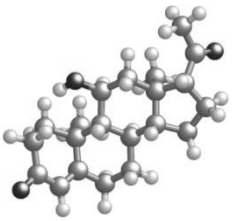

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Name: …… **( )**

Class: ……

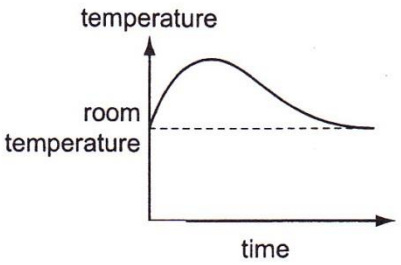
Date: …… **/** …… **/** ……

Energy from Chemicals – Assignment

Question 1:

Dissolving ammonium nitrate in water is endothermic. Which graph shows how the temperature alters as the ammonium nitrate is added to water and then the solution is left to stand?

A



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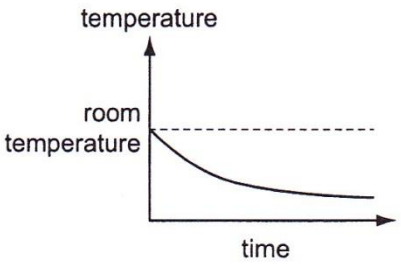

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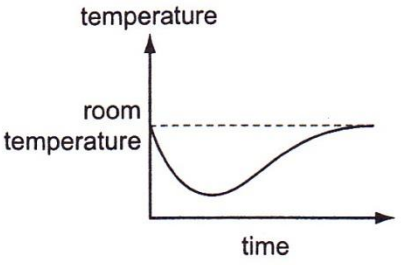

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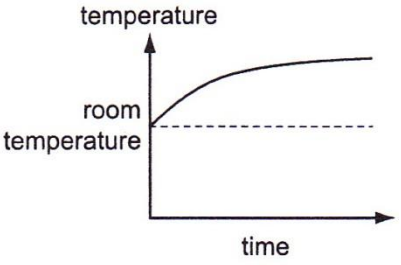


Question 2:

The formation of hydrogen iodide from hydrogen and iodine is an endothermic reaction.

$$H–H + I–I \rightarrow H–I + H–I$$

What information may be deduced from this information?

A The number of bonds broken is greater than the number of bonds formed.

B The formation of H–I bonds absorbs energy.

C The products possess less energy than the reactants.

D The total energy change in bond formation is less than that in bond breaking.

Question 3:

The table shows the energy released by the complete combustion of some compounds as fuels.

Compound	Formula	M_r	ΔH in kJ / mol
Methane	CH_4	16	–880
Ethanol	C_2H_5OH	46	–1380
Propane	C_3H_8	44	–2200
Heptane	C_7H_{16}	100	–4800

Which fuel produces the most energy when 1 g of the compound is completely burned?

A Ethanol. **B** Heptane.

C Methane. **D** Propane.

Question 4:

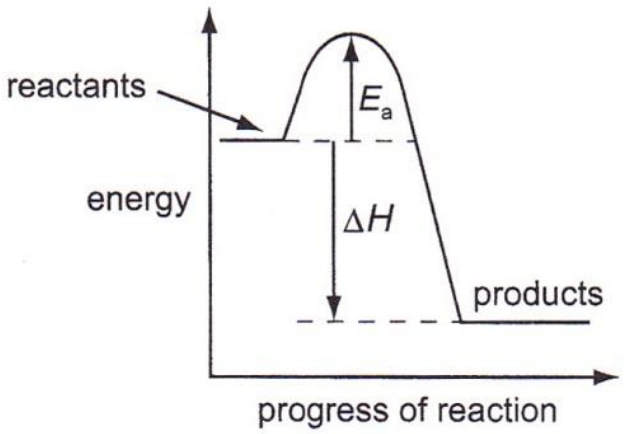
On combustion, which fuel **never** produces pollutants?

A Diesel. **B** Hydrogen.

C Methane. **D** Petrol.

Question 5:

The enthalpy diagram shows an uncatalysed, exothermic reaction.



The reaction was repeated in the presence of a catalyst.

What effect does the catalyst have on the activation energy, E_a, and the enthalpy change, ΔH?

A E_a decreases and ΔH decreases.

B E_a decreases and ΔH unchanged.

C E_a increases and ΔH increases.

D E_a unchanged and ΔH decreases.

Question 6:

The scheme shows four stages, I to IV, in the conversion of solid candlewax, $C_{30}H_{62}$, into carbon dioxide and water.

I $C_{30}H_{62(s)} \rightarrow C_{30}H_{62(l)}$

II $C_{30}H_{62(l)} \rightarrow C_{30}H_{62(g)}$

III $C_{30}H_{62(g)} + 45.5O_{2(g)} \rightarrow 30CO_{2(g)} + 31H_2O_{(g)}$

IV $30CO_{2(g)} + 31H_2O_{(g)} \rightarrow 30CO_{2(g)} + 31H_2O_{(l)}$

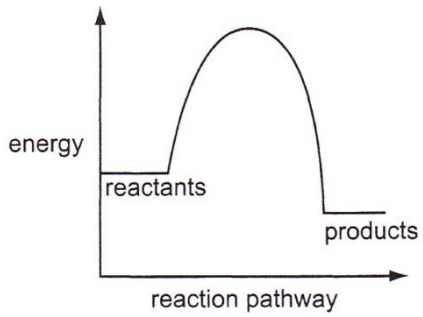
Which stages are exothermic?

A I and II. **B** II and III.

C III and IV. **D** I and IV.

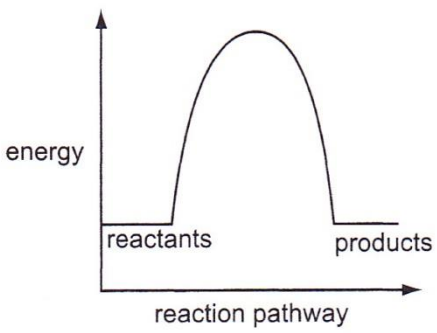
Question 7:

The energy profile diagram for a given reaction without the use of a catalyst is shown below.



Which energy profile diagram is correct when a catalyst is used?

A



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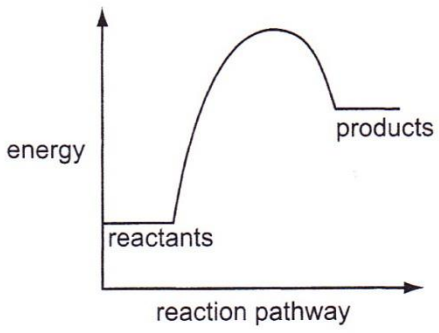

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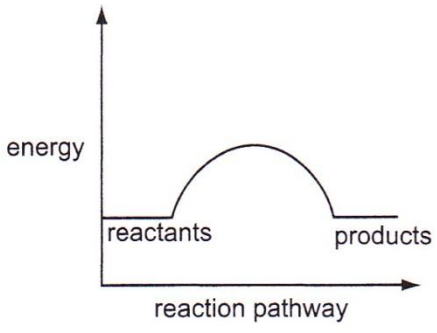

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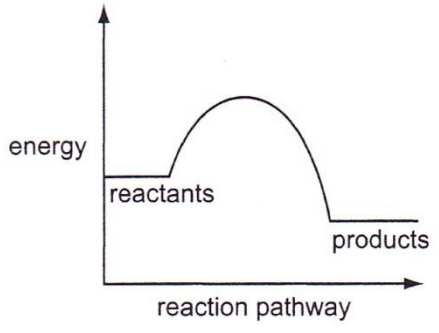
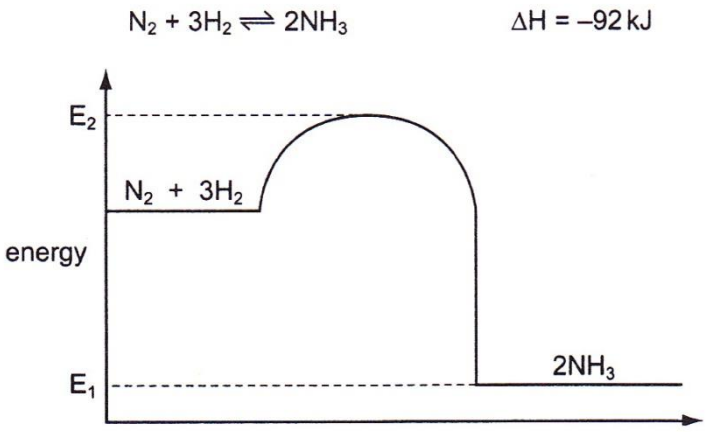


Question 8:

The energy profile diagram is that for the Haber process.



What does the energy change $E_2 - E_1$ represent?

A Activation energy of the forward reaction.

B Activation energy of the reverse reaction.

C Enthalpy change of the forward reaction.

D Enthalpy change of the reverse reaction.

Question 9:

Which one of the following reactions is **endothermic**?

A $2H \rightarrow H_2$

B $2H_2 + O_2 \rightarrow 2H_2O$

C $H_2 + Cl_2 \rightarrow 2HCl$

D $Cl_2 \rightarrow 2Cl$

Question 10:

Which one of the following does **not** involve the release of energy?

A The mixing of dilute sulphuric acid with sodium hydroxide.

B The mixing of concentrated sulphuric acid with water.

C The formation of sugars by photosynthesis.

D The formation of hydrogen molecules from hydrogen atoms.

Question 11:

Which statement is correct for all exothermic reactions?

A A catalyst is needed for the reaction to take place.

B Light is absorbed during the reaction.

C The products of the reaction have less energy than the reactants.

D They are reactions which require heat to start.

Question 12:

Ammonia is decomposed into nitrogen and hydrogen according to the following equation:

$$2NH_3 \rightarrow N_2 + 3H_2 \quad \Delta H = +92 \text{ kJ/mol of nitrogen}$$

What is the energy change when 34 g of ammonia is decomposed?

A 92 kJ Given out. **B** 92 kJ Absorbed.

C 184 kJ Given out. **D** 184 kJ Absorbed.

Fill in your answers to the multiple choice questions in the table below:

1.	**2.**	**3.**	**4.**	**5.**	**6.**
7.	**8.**	**9.**	**10.**	**11.**	**12.**

Question 13:

Liquid petroleum gas (LPG) and ethanol can be used as fuels for cars instead of petrol. LPG contains mainly propane. The table shows some information about propane and ethanol.

Name	Formula	Boiling Point / °C	Physical State at r.t.p.	Enthalpy Change of Combustion kJ / mol	Method of Manufacture
Ethanol	……	78	……	–1367	Fermentation of sugar cane
Propane	C_3H_8	–42	……	–2220	…….. …….. of crude oil

a) Complete the table by filling in the boxes.

[4]

b) When 1 kg of propane burns, 50 450 kJ of energy are given out. Show by calculation, using data from the table, that ethanol gives out less energy per kg than propane.

[3]

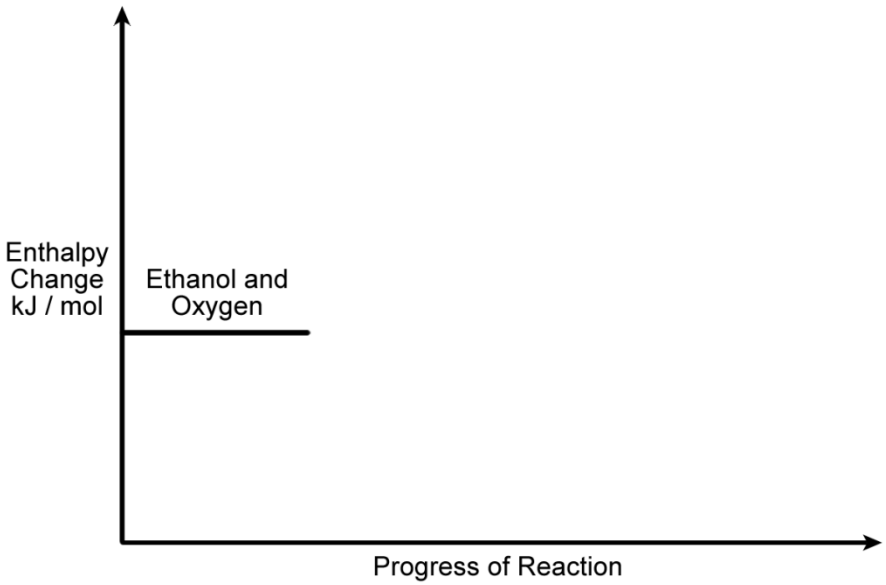
c) Give **two advantages** of using ethanol rather than propane as a fuel for cars.

……

……

[2]

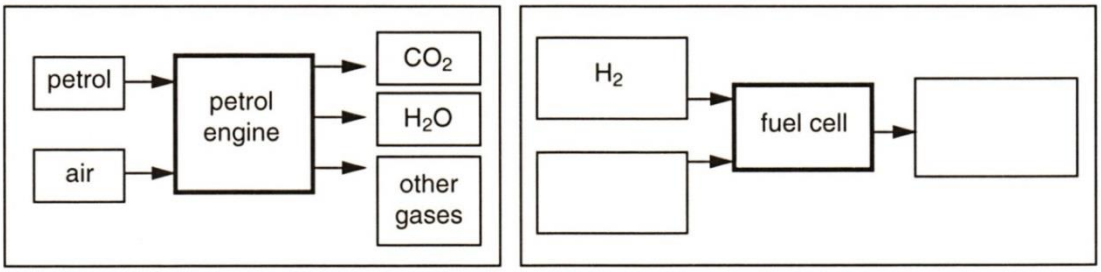
d) In a car engine, a spark plug ignites a mixture of air and ethanol. The spark is needed because the combustion of ethanol needs activation energy.
Complete the energy level diagram below for the combustion of ethanol. Show the names of the products and label the activation energy for the reaction.



[3]

Question 14:

Most vehicles have petrol or diesel engines, but some use fuel cells. The flow charts show the substances entering and leaving a petrol engine and a fuel cell.



a) Complete the flow chart for the fuel cell by filling in the empty boxes. [1]

b) Using ideas about bond breaking and bond formation, explain why the combustion of petrol in the petrol engine is *exothermic*. [3]

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c) The waste products from vehicles with petrol engines cause more harm to human health than those from vehicles with fuel cells. Explain why this statement is true. [3]

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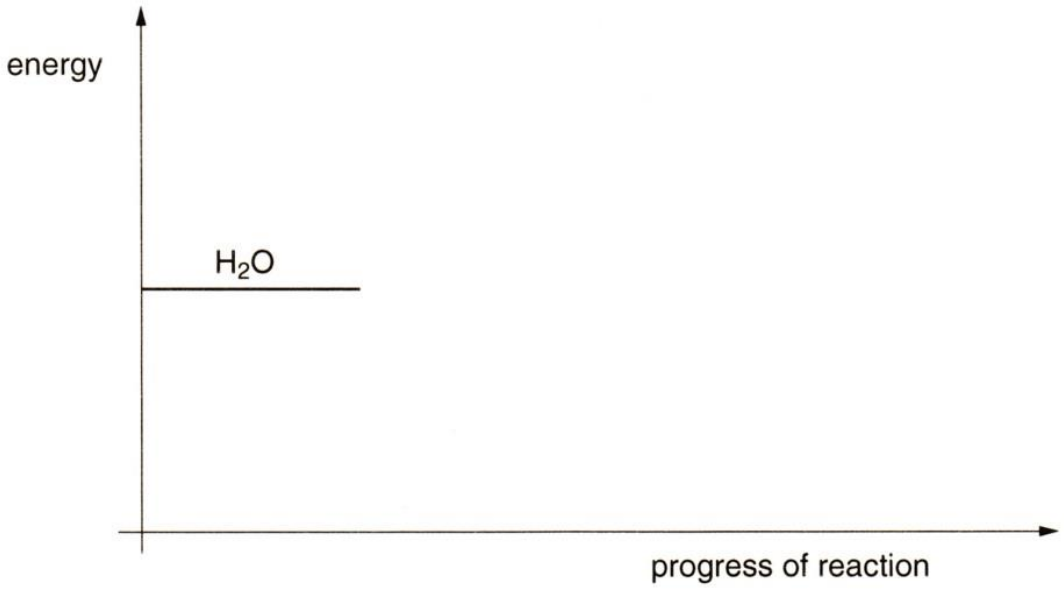
d) Hydrogen for fuel cells can be obtained from water by electrolysis. Electricity is used to provide energy for the electrolysis. Complete the energy profile diagram for the electrolysis of water. Your diagram should include:

- The **formulae of the products** of electrolysis.
- A label for the **enthalpy change of reaction**. [2]



e) Some people think that hydrogen is a completely non-polluting fuel. Explain why this is incorrect. [2]

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[Total: 8]

Question 15:

In the presence of a suitable catalyst, the chemical hydrazine (formula, N_2H_4) decomposes into nitrogen and hydrogen as shown in the equation below.

a) Using the bond energies given below, calculate the overall energy change for the decomposition of hydrazine.

N–N = 163 kJ

N–H = 388 kJ

N≡N = 944 kJ

H–H = 436 kJ

[3]

b) Is the decomposition of hydrazine exothermic or endothermic?

……..

+ + + End of Assignment + + +

- Scan the QR Code below for the answers to this assignment.

http://www.chemist.sg/energy_changes/assignment_energy_from_chemicals_ans.pdf