Chemical Energetics – 2022 Nov IGCSE Chemistry 0620

1. Nov/2022/Paper_11/No.11

When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

A decomposition and endothermic

B decomposition and exothermic

C neutralisation and endothermic

D neutralisation and exothermic

2. Nov/2022/Paper_11/No.12

Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

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3. Nov/2022/Paper_12/No.11

When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

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4. Nov/2022/Paper_12/No.12

Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point /°C	boiling point /°C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

5. Nov/2022/Paper_13/No.11

When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

A decomposition and endothermic

B decomposition and exothermic

C neutralisation and endothermic

D neutralisation and exothermic

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6. Nov/2022/Paper_13/No.12

Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point /°C	boiling point /°C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

7. Nov/2022/Paper_21/No.11

When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

A decomposition and endothermic

B decomposition and exothermic

C neutralisation and endothermic

D neutralisation and exothermic

8. Nov/2022/Paper_21/No.12

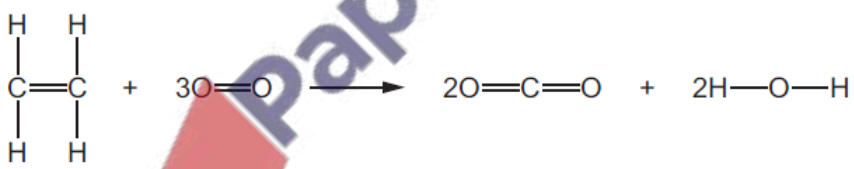
Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

9. Nov/2022/Paper_21/No.13

Ethene can undergo complete combustion, as shown.



Some bond energies are given in the table.

bond	bond energy in kJ / mol
C=C	612
C–H	412
O–H	463
O=O	496

The energy change of the reaction is –1408 kJ / mol.

What is the bond energy of the C=O bond in CO_2?

A 454 kJ / mol **B** 673 kJ / mol **C** 826 kJ / mol **D** 1619 kJ / mol

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10. Nov/2022/Paper_22/No.11

When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

A decomposition and endothermic

B decomposition and exothermic

C neutralisation and endothermic

D neutralisation and exothermic

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11. Nov/2022/Paper_22/No.12

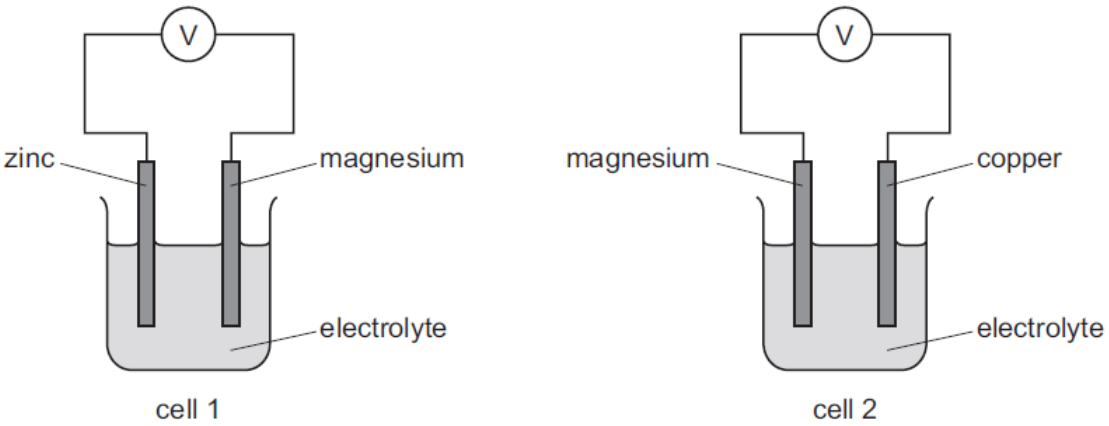
Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

12. Nov/2022/Paper_22/No.13

The electrical energy, or voltage, of two simple cells is measured.



statement 1 The voltage of cell 1 is greater than cell 2.

statement 2 Zinc is more reactive than copper.

statement 3 Magnesium is oxidised in both cells.

statement 4 Magnesium atoms lose electrons to form magnesium ions.

Which option is correct?

A All the statements are correct.

B Only statements 1 and 3 are correct.

C Statement 2 is correct and explains statement 1.

D Statement 4 is correct and explains statement 3.

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13. Nov/2022/Paper_23/No.11

When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

A decomposition and endothermic

B decomposition and exothermic

C neutralisation and endothermic

D neutralisation and exothermic

14. Nov/2022/Paper_23/No.12

Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

15. Nov/2022/Paper_23/No.17

The equation for the reaction between ethene and hydrogen is shown.

$$CH_2{=}CH_2(g) + H_2(g) \rightarrow CH_3{-}CH_3(g)$$

The bond energies are shown.

bond	bond energy in kJ / mol
C=C	612
H–H	436
C–C	348
C–H	416

What is the overall energy change during this reaction?

A –284 kJ / mol

B –132 kJ / mol

C +132 kJ / mol

D +284 kJ / mol

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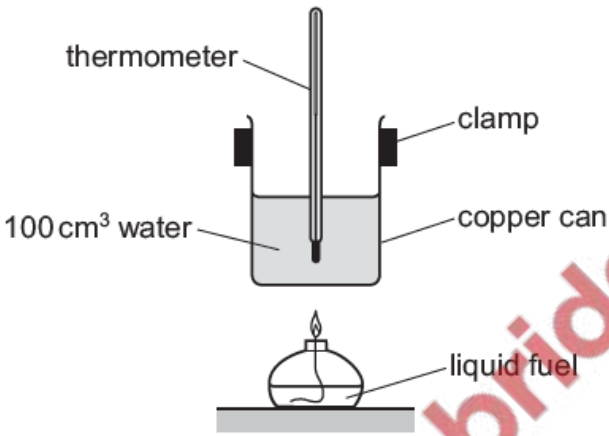
16. Nov/2022/Paper_31/No.3

This question is about fuels and energy production.

(a) Name a fuel that is a solid at room temperature.

..... [1]

(b) The diagram shows the apparatus used to compare the energy released when 100 cm^3 of water is heated by burning different liquid fuels, **J**, **K**, **L** and **M**.



All conditions are kept the same, apart from the type of fuel and mass of fuel burned.

The results are shown.

fuel	mass of fuel burned / g	increase in temperature / °C
J	1	5
K	2	9
L	1	6
M	3	12

Deduce which fuel, **J**, **K**, **L** or **M**, releases the most energy per gram.

..... [1]

(c) Name the type of chemical reaction that releases heat energy.

..... [1]

(d) Name the **two** products formed when a hydrocarbon fuel undergoes complete combustion.

..... and ..... [2]

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(e) (i) Choose from the list the radioactive isotope used as a source of energy.

Draw a circle around your answer.

^{27}Al ^{23}Na ^{16}O ^{235}U [1]

(ii) State one **other** industrial use of radioactive isotopes.

..... [1]

[Total: 7]

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17. Nov/2022/Paper_32/No.3

This question is about fuels and energy production.

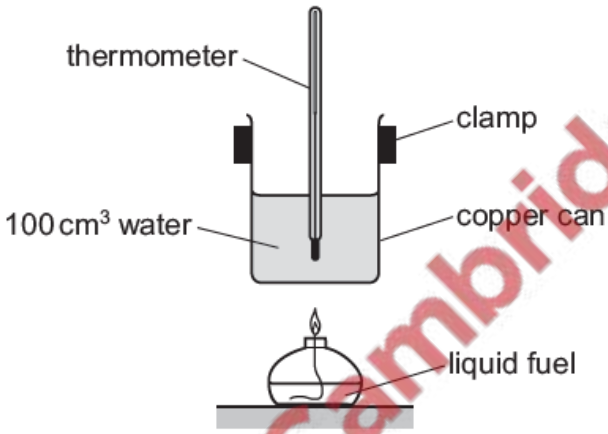
(a) Chemical reactions can be endothermic or exothermic.

State the meaning of the term *endothermic*.

.....

..... [1]

(b) The diagram shows the apparatus used to compare the energy released when 100 cm^3 of water is heated by burning different liquid fuels, **P**, **Q**, **R** and **S**.



All conditions are kept the same, apart from the type of fuel and mass of fuel burned.

The results are shown.

fuel	mass of fuel burned / g	increase in temperature / °C
P	3	6
Q	2	8
R	1	3
S	3	9

Deduce which fuel, **P**, **Q**, **R** or **S**, releases the least energy per gram.

..... [1]

(c) Name a gas that is used as a fuel.

..... [1]

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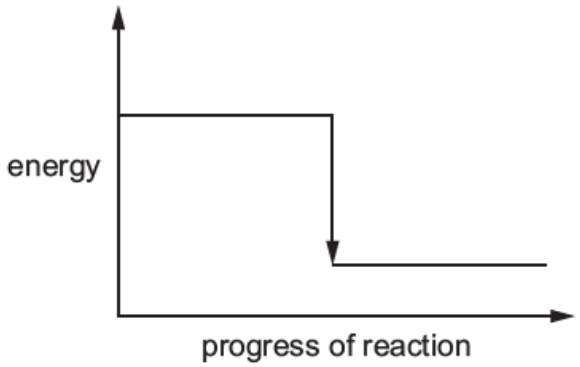
(d) An energy level diagram for the burning of a fuel is shown.



Complete the diagram using these words:

- products
- reactants.

[1]

(e) The radioactive isotope ^{235}U is used as a source of energy.

State one **other** use of radioactive isotopes.

..... [1]

[Total: 5]

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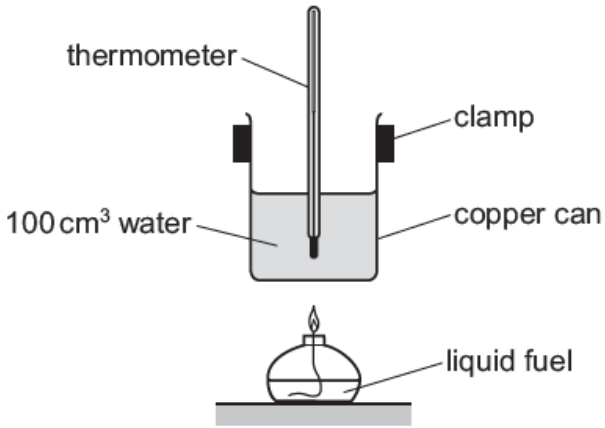
18. Nov/2022/Paper_33/No.3

This question is about fuels and energy production.

(a) The diagram shows the apparatus used to compare the energy released when 100 cm^3 of water is heated by burning different liquid fuels, **J**, **K**, **L** and **M**.



All conditions are kept the same apart from the type of fuel and mass of fuel burned.

The results are shown.

fuel	mass of fuel burned / g	increase in temperature / °C
J	2	4
K	4	8
L	1	3
M	2	5

Deduce which fuel, **J**, **K**, **L** or **M**, releases the most energy per gram.

..... [1]

(b) The fractional distillation of petroleum produces fractions, such as gasoline and diesel, which are used as fuels.

(i) Name one **other** petroleum fraction that is used as a fuel.

..... [1]

(ii) State the physical property on which the fractional distillation of petroleum depends.

..... [1]

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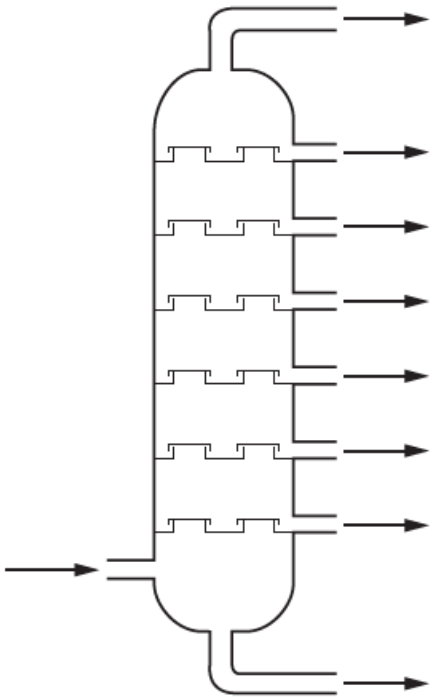
(iii) Bitumen is a fraction of petroleum.

Write an X **on the diagram** to show where bitumen is obtained.



[1]

(c) (i) Name a radioactive element that is used as a source of energy in nuclear power stations.

..... [1]

(ii) State one **other** industrial use of radioactive isotopes.

..... [1]

[Total: 6]

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19. Nov/2022/Paper_41/No.5

Ethene is an alkene which reacts with bromine as shown in the equation.

$$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$$

(a) Write the general formula of alkenes.

..... [1]

(b) Describe the colour change seen when ethene is bubbled through aqueous bromine.

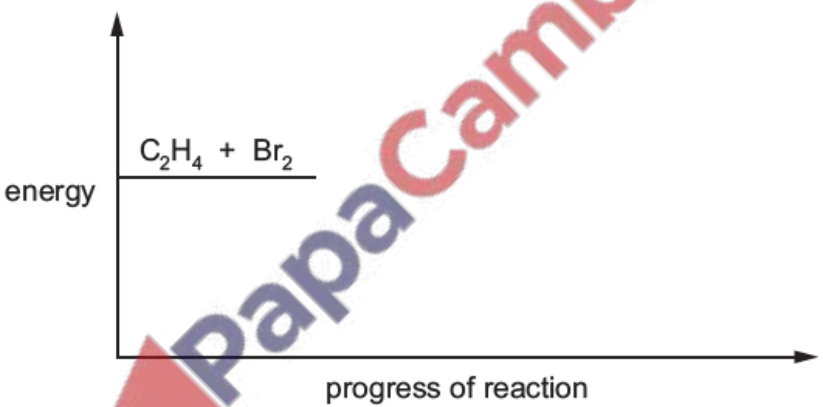
from ..... to ..... [1]

(c) In this reaction only one product is formed from two reactants.

Name this type of organic reaction.

..... [1]

(d) Part of the energy profile diagram of this reaction is shown.



(i) The reaction is exothermic.

Complete the energy profile diagram for this reaction.
Include:

- the position of the products
- an arrow to show the activation energy, labelled as A
- an arrow to show the energy change for the reaction.

[3]

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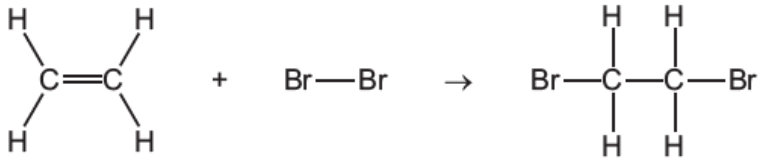
(ii) The chemical equation for the reaction can be represented as shown.



Some bond energies are given.

bond	bond energy / kJ mol
C–H	410
C=C	610
Br–Br	190
C–C	350
C–Br	290

Use the bond energies in the table to calculate the energy change in this reaction.

Use the following steps.

- Calculate the energy needed to break bonds.

energy = ... kJ

- Calculate the energy released in making bonds.

energy = ... kJ

- Determine the energy change in this reaction.

energy change in this reaction = ... kJ / mol
[3]

[Total: 9]

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20. Nov/2022/Paper_42/No.5

Ethane is an alkane which undergoes a photochemical reaction with chlorine as shown.

$$C_2H_6(g) + Cl_2(g) \rightarrow C_2H_5Cl(l) + HCl(g)$$

(a) Write the general formula of alkanes.

..... [1]

(b) State why this reaction is described as a photochemical reaction.

..... [1]

(c) In this reaction, an atom of hydrogen is replaced with a chlorine atom.

State the name of this type of organic reaction.

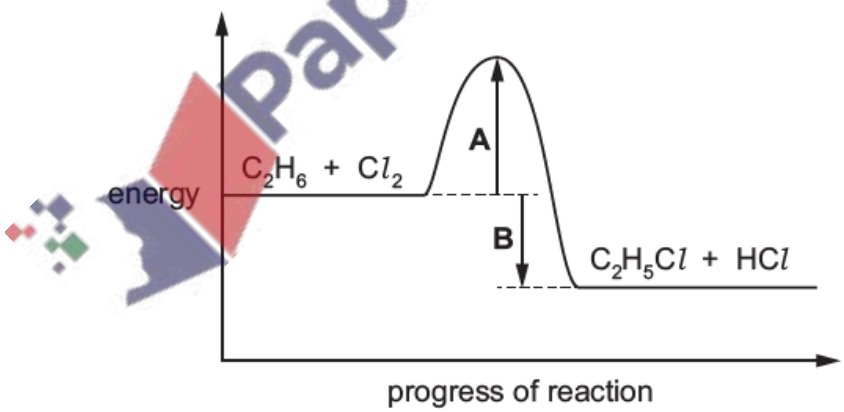
..... [1]

(d) In this reaction, one of the products is chloroethane.

Name the other product.

..... [1]

(e) The energy profile diagram of this reaction is shown.



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(i) Name the energy change labelled **A**.

..... [1]

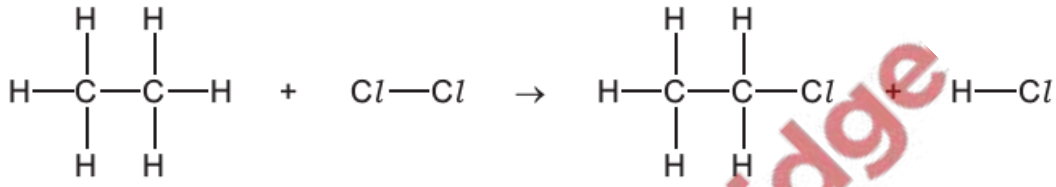
(ii) Name the energy change labelled **B**.

..... [1]

(iii) State how the energy profile diagram shows this is an exothermic reaction.

..... [1]

(f) The equation for the reaction can be represented as shown.



Some bond energies are given.

bond	bond energy /kJ mol
C–H	410
C–C	350
Cl–Cl	240
C–Cl	340
H–Cl	430

Use the bond energies in the table to calculate the energy change in this reaction.

Use the following steps.

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- Calculate the energy needed to break bonds.

energy = ... kJ

- Calculate the energy released in making bonds.

energy = ... kJ

- Determine the energy change in this reaction.

energy change in this reaction = ... kJ / mol
[3]

[Total: 10]

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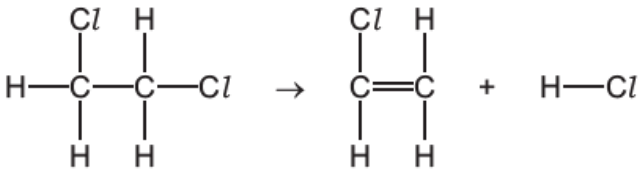
21. Nov/2022/Paper_43/No.6(a)

(a) Chloroethene (CH_2=$CHCl$) can be manufactured from 1,2-dichloroethane (CH_2ClCH_2Cl).

The equation can be represented as shown.



(i) Some bond energies are given.

bond	bond energy in kJ/mol
C–C	350
C=C	610
C–Cl	340
C–H	410
H–Cl	430

Use the bond energies in the table to calculate the energy change, in kJ/mol, of the reaction.

Use the following steps.

- Calculate the energy needed to break bonds.

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energy = ... kJ

- Calculate the energy released when bonds form.

energy = ... kJ

- Calculate the energy change of the reaction.

energy change of the reaction = ... kJ / mol
[3]

(ii) Deduce whether the energy change for this reaction is exothermic or endothermic.

Give a reason for your answer.

.....

..... [1]

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