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**GCSE Combined Science**

**(and Chemistry)**

**Student Answer Booklet**

**Energy Changes**

**Contents:**

1. ANSWERS Multiple Choice Quiz
2. ANSWERS Exam Practice

**Level 1 ANSWERS**

**GCSE Chemistry – Energy changes**

1. **a**
2. **b**
3. **c**
4. **a**
5. **d**
6. **a**
7. **c**
8. **d**
9. **b**
10. **a**

**Exam Practice:**

**Question 1**

(a)     water / H2O

allow steam or hydrogen oxide

1

(b)     (i)      A

1

(ii)     exothermic

1

products (energy) lower than reactants (energy)

1

(iii)     1860 (kJ)

1

(c)     (i)      22.5

1

38.7

1

16.2

allow ecf for correct subtraction

1

(ii)     50 (g)

1

(iii)    20.1 (kJ)

allow propanol

ignore 3

1

(iv)    as the number of carbon atoms (in one molecule of alcohol) increases the heat energy given out increases (when the alcohol is burned)

1

(v)     any **two** from:

•        no lid

•        no insulation

•        no draught shield

Allow heat / energy loss to surroundings for any one of these marks

•        incomplete combustion

•        inaccurate measurement

•        no repeats (to calculate a mean)

2

(iv)    -O-H

1

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**Question 2:**

(a)     line goes up before it goes down

1

energy given out correctly labelled

1

activation energy labelled correctly

1

(b)     electrostatic force of attraction between shared pair of negatively charged electrons

1

and both positively charged nuclei

1

(c)     bonds formed = 348 +4(412) + 2(276) = 2548 kJ / mol

1

bonds broken − bonds formed = 612 + 4(412) + (Br-Br) − 2548 = 95 kJ / mol

1

Alternative approach without using C-H bonds

For step 1 allow = 348 + 2(276) = 900 kJ / mol

Then for step 2 allow 612 + (Br-Br) − 900 = 95 kJ / mol

193 (kJ / mol)

1

accept (+)193 (kJ / mol) with no working shown for **3** marks

−193(kJ / mol) scores **2** marks

allow ecf from step 1 and step 2

(d)     **Level 3 (5–6 marks):**

A detailed and coherent explanation is given, which demonstrates a broad understanding of the key scientific ideas. The response makes logical links between the points raised and uses sufficient examples to support these links. A conclusion is reached.

**Level 2 (3–4 marks):**

An explanation is given which demonstrates a reasonable understanding of the key scientific ideas. A conclusion may be reached but the logic used may not be clear or linked to bond energies.

**Level 1 (1–2 marks):**

Simple statements are made which demonstrate a basic understanding of some of the relevant ideas. The response may fail to make logical links between the points raised.

**0 marks:**

No relevant content.

**Indicative content**

Size and strength

•        chlorine atoms have fewer electron energy levels/shells

•        chlorine atoms form stronger bonds

•        Cl–Cl bond stronger than Br–Br

•        C–Cl bond stronger than C–Br

Energies required

•        more energy required to break bonds with chlorine

•        more energy given out when making bonds with chlorine

•        overall energy change depends on sizes of energy changes

Conclusions

•        if C−Cl bond changes less, then less exothermic

•        if C−Cl bond changes more, then more exothermic

•        can’t tell how overall energy change will differ as do not know which changes more.

6

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**Question 3:**

(a)     the relative energies of the reactants, products and the overall energy change

**1**

the activation energy

**1**



(b)     (4 × 413) + (2 × 498) = 2 648

**1**

(2 × 805) + (4 × 464) = 3 466

**1**

(3466 − 2648 =) 818 (kJ / mol)

**1**

*allow max* ***2*** *marks for one ecf*