AS Chemistry

Unit 2 Practice Exam Questions – Test 4

**1.** (a) (i) C5H8 1

(ii) C5H8 1

(b) (i) Ni/Pt/Pd 1

(ii) 1 mark for C5H12 1

1 mark for correct balancing 1

(iii)



 1

[6]

**2.** (i) electron/lone pair acceptor 1

(ii)



 1

 1

 1

[4]

**3.** (i) *Mr* of 2-methylpropan-1-ol = 74 1

moles = 4.44/74 = 0.06 1

(ii) moles = 5.48/137 = 0.04 1

(iii) 66.7% 1

[4]

**4.** (i) correctly shows three repeat units with ‘end bonds’ 1

correctly identifies the repeat unit 1



(ii) harmful/toxic fumes are produced 1

(iii) recycle/remove HC*l* by using gas scrubbers or wtte/crack polymers/used
a feedstock/ source of fuel (in an incinerator)/developing
biodegradable alternatives. 2

[5]

**5.** The C–Halogen bond most likely to be broken is **C–Br** because it is the weakest bond

[1]

**6.** (i) C*l*2  2C*l* 1

(ii) uv (light)/high temperature/min of 400  C/sunlight 1

(iii) C*l*  C6H12  C6H11  HC*l*

C6H11  C*l*2  C6H11C*l*  C*l* 1

(iv) react with each other/suitable equation

solvent **W** = water/aqueous/aqueous ethanol 1

solvent **X** = ethanol/alcohol 1

[5]

**7.** (a) (i) H2SO4 – any mention of (aq) loses the mark 1

(ii) any correct formula/structure or name for benzoic acid 1

(b) (i) dichromate/Cr2O72–/permanganate 1

(ii) 1



[4]

**8.** Structural/chain/positional isomers have the same molecular formula,
different structure 1

but-1-ene/ but-2-ene/ methylpropene / cyclobutane/ methylcyclopropane

(any three or two with correct structures and names) 3

***4 marks for structural isomerism***

*Cis-trans* /geometric isomerism 1

*cis & trans* but-2-ene clearly identified 1

C=C prevents rotation 1

each C in the C=C double bond must be bonded to two different atoms or groups 1

***4 marks for cis-trans isomerism***

QWC: Well organised answer making use of correct terminology to include
any **three** from: structural, geometric, cis-trans, molecular formula, restricted,
rotation, stereoisomerism, stereoisomers, chain isomerism, positional isomerism,
if all isomers are correctly named 1

[9]

**9.** CO from incomplete combustion/ insufficient oxygen 

NO from nitrogen and oxygen in **the air** 

[2]

**10.** (i) C*l*O  **O**  C*l*  O2  1

(ii) O3  O  2O2  1

(iii) effect of uv radiation/ homolytic fission/

effect of sunlight  2

on CFCs/ on chlorocarbons 

(iv) increase (skin cancer)  1

[5]

**11.** (i) to break a bond energy has to be put in/ 

breaking bonds is endothermic 1

(ii) energy needed to break 1 mole **of bonds** 

in the **substance** in the gaseous state  2

(iii) bonds broken:

3(C–H)  (C–O)  (O–H)  1½ (O=O) = 2781 kJ 

bonds made:

2(C=O)  4(O–H) = 3470 kJ 

Hc = − 689  (kJ mol−1) 3

(iv) actual bond enthalpies may be different from average values 

 conditions are not standard / methanol/ water is a liquid under
standard conditions  2

[8]

**12.** (i) more CO and H2/ less CH3OH/ moves to LHS 

reaction is exothermic/ ora  4

(moves in endothermic direction scores 1)

less CO and H2/ more CH3OH/ moves to RHS 

more mole/molecules/particles on LHS/ ora 

(ii) more particles per unit volume/

increased concentration/ particles closer together 

more collisions **and** increases rate 2

(iii) heterogeneous  1

(iv) none 

affects forward and reverse reaction the **same**  2

[9]

**13.** (a) the statement is true because there are more collisions (as temperature increases) 
increase in temperature increases the velocity/ energy of particles 
rate increases (with increase in temperature) more than can be explained by this/
**but** not all collisions are successful 
to be successful collisions must exceed *E*a 
if temperature increased higher proportion of collisions exceed *E*a  5

 (b) (i) *y* axis: fraction/ number of particles/ molecules/ atoms  2

 *x* axis: energy/ velocity 

(ii) line labelled T2 with higher maximum 

 maximum to LHS of original line 

 (must start at 0.0, be below original curve at higher energies,
cut the other curve only once and not cross the  axis 2

[9]

**14.** (i) (enthalpy/ energy change) when 1 mole of substance/compound formed 

from its elements 

 under standard conditions  (if conditions quoted must be
correct – 25  C/298 K, 1 atm/100 kPa/101 kPa) 3

(ii) Mg(s)  N2(g)  3O2(g)  Mg(NO3)2(s)

balanced species 

state symbols  2

(iii) cycle 

x – 791 = −602 – 2(33) 

x = 123  3

[8]

Examiners Report

**1.** (a) This was generally very well answered with many scoring both marks. It was unfortunate that a ‘C’ was not shown in the structural formula of isoprene but the Examiners compensated candidates by crediting both C5H8 and C4H8.

(b) Most scored the mark in (i) but very many failed to score both marks in (ii). It was common to see equations for partial hydrogenation. Candidates who had misinterpreted the structural formula of isoprene in (a)(i) were also given credit in this section.

 The partial hydrogenation of limonene was reasonably well done but it was not uncommon to see isoprene rather than limonene. A surprising number indicated an extra C by drawing structures that revealed a misunderstanding of skeletal formulae such as those shown below.



**2.** (i) This was surprisingly badly answered with very many not scoring the mark.

(ii) As always the response to the mechanism was very Centre-specific and it was often three marks or none. It is important that Centres look carefully at the mark schemes to see what is required to score the marks.

**3.** Able candidates scored all four marks but weaker candidates demonstrated a variety of errors. Many candidates do not seem to be comfortable with numbers. Percentage yields exceeding 100% were seemingly not challenged.

**4.** (i) Most scored at least one mark but many failed to follow the instructions within the question and ‘put a bracket round one of the repeat units’.

(ii) This was straightforward but many lost the mark by either describing CO2 as a toxic gas or by stating that the fumes would damage the ozone layer.

(iii) This was generally well answered.

**5.** Some candidates were confused over the role of electronegativity of the halogen and others incorrectly identified C–F as the weakest bond.

**6.** (i), (ii) Both parts were well answered.

(iii) The propagation steps still reveal a lack of understanding by a substantial number of candidates.

**7.** (a) Many identified the catalyst but only a few deduced the correct structure of the acid.

(b) The oxidising agent was well known but the majority failed to construct a balanced equation for the oxidation.

**8.** Few if any scored full marks for this question. Most failed to structure their answer and often forgot to include either structural isomers or *cis-trans* isomers. A substantial number appear to have misunderstood the question and wrote at length firstly about isomerisation and then about cracking and reforming. The quality of written communication mark appeared more elusive than usual with many failing to correctly use specific chemical terms in the correct context.

**9.** Most candidates recognised that carbon monoxide is produced as the result of incomplete combustion of the fuel. Whilst most realised that nitrogen monoxide uses oxygen and nitrogen from the air some thought that at least one of these was in some way present in the fuel.

**10.** (i) Most candidates correctly completed the equation.

(ii) This proved challenging with a large number writing 2O3  3O2 rather than actually using the equations as given.

 (iii) Most candidates recognised the function of uv light but many suggested that it was chorine itself, rather than CFCs, that was involved in the homolytic fission reaction.

 (iv) Whilst a large number of answers were specific and quoted the increased risk of skin cancer on exposure to uv radiation, weaker candidates were clearly confused and effects based on global warming were not uncommon.

**11.** (i) To gain credit for this part, it was necessary to recognise that bond breaking was involved. Some candidates showed their lack of understanding when they quoted bond making or both breaking and making.

 (ii) Since this is a standard definition, it was disappointing how many candidates omitted reference to 1 mole or broke the bonds in 1 mole of substance.

 (iii) The calculation was generally well done with only a minority of candidates reversing the signs of the enthalpy changes needed for breaking and making the bonds. *{Numerical answer: –689 kJ mol–1}*

 (iv) This is an example where candidates saw a statement about differences between enthalpy change values and related this to some sort of experimental error rather than actually considering the sources of the values being compared.

**12.** (i) The use of le Chatelier’s principle is an important concept in this unit and most candidates clearly understood it and were able to apply it to the example given. Very few examples were therefore seen when the rate of attainment of the equilibrium was confused with the equilibrium position.

 (ii) Most candidates correctly related the increase in rate to an increased number of collisions with very few trying to alter activation energy.

 (iii) Apart from a few who suggested specific metals or who confused heterogeneous with heterolytic or heterozygous, this was well known.

(iv) Most candidates were able to quote that the use of a catalyst would not alter the equilibrium position but significantly less actually explained why.

**13.** (a) Although the question required candidates to use their knowledge of the effect of temperature on particle motion, to gain full credit it was necessary to examine critically the difference between an increased rate of collision and an increased rate of reaction. Some candidates read the question carefully and gave excellent explanations but many others apparently saw the words ‘rate’ and ‘temperature’ and merely gave a standard description of activation energy. This would allow them access to four of the available five marking points.

(b) (i) Most candidates labelled the axes in a recognisable manner but some were clearly confused with enthalpy profile diagrams whilst a small number omitted the labelling completely.

(ii) On previous occasions candidates have often been required to draw the distribution at a higher temperature. A number appeared to read the question in this way. Although only a sketch was needed, so that credit was given if the curve was to the left of and higher than the original, candidates would be advised to be careful when completing their sketch. Credit was not given when their line crossed either the x axis or the line for *T1* at high energy values.

**14.** (i) As with the previous definition, a significant number of answers were seen that omitted 1 mole or that the compound was formed from its elements.

(ii) Many correct equations were given with only a few starting from formulae other than elements. This error was seen occasionally even if the definition in (i) actually stated ‘ from the elements’.

(iii) Many numerically correct answers were seen and the best candidates explained clearly the way in which they reached their answer. For some weaker candidates, even those with a correct answer or one that was only incorrect in its sign, the method of calculation was less convincing. *{Numerical answer: 123 kJ mol–1}*