AS Chemistry

Unit 2 Practice Exam Questions – Test 2

**1.** (a) (i) 24.7/12 : 2.1/1: 73.2/35.5

2.06 : 2.1 : 2.06 1

 CHC*l* 1

(ii) (CHC*l* = 12  1  35.5 =) 48.5 1

 48.5  3 = 145.5 1

(b) (i) Any two from 2



(ii) 1, 2,3-trichloropropene

(trichloropropene scores 1 mark )

3 marking points:

  correct numbers 1, 2,3
 trichloro
 propene/prop-1-ene

any two gets 1 mark

 2

(c) (i) 2



1 mark if backbone contains 4 carbons with ‘end-
bonds’ and a reasonable attempt has been made
e.g used the wrong isomer…. max = 1 mark

(ii) non-biodegradable 1

 toxic fumes evolved when burnt 1

 HC*l* or C*l* or chlorinated organic compounds such as COC*l*2 also
evolved when burnt 1

[13]

**2.** (i) decolourises 1

(ii)



curly arrow from CC bond to bromine 1

dipoles on Br2 or curly arrow to show movement of bonded pair of electrons 1

intermediate carbonium ion/carbocation 1

curly arrow from lone pair on the Br- ion to carbonium ion (Br- loses 1 mark) 1

[5]

**3.** (i) 1



require an attempt at a 3D structure and
bond angles must clearly not be 90.

require at least one ‘wedge’ bond or one
‘dotted’ bond

(ii) 108  111 1

(iii) volatile/low boiling/gas/non-toxic/non-flammable/unreactive/liquefied under pressure/inert 1

(iv) homolytic  bonded pair split equally/ each retains 1 electron 1

fission  bond breaking 1

(v) C-C*l* (no mark) because it is the weaker bond 1

(vi) C*l* 1

CF3 (allow CF3) 1

(lack of ‘dots’ penalise once)

[8]

**4.** C6H12O6  2C2H5OH  2CO2

(C2H5OH & CO2 )

[2]

**5.**



dipoles 1

hydrogen bond between O in one O-H
and H in the other O-H 1

lone pair from O involved in the H-bond 1

[3]

**6.** (a) (i) (volatile components) can escape/distil out 1

 ethanal is most volatile/b pt less than 60C/partial oxidation 1

(ii) (volatile components) cannot escape/ refluxed 1

 complete oxidation will be achieved/oxidised to the acid 1

(b) C2H5OH  2[O]  CH3COOH  H2O

 (CH3COOH  H2O ) 2

(c) spectrum C 1

spectrum C only shows absorption at 1700 cm-1 for the CO 1

the other two spectra contain the OH group absorption at approx 3000 cm-1 1

[9]

**7.** identifies the three process as cracking, reforming, isomerisation 1

recognises the need for high temperature or a catalyst 1

equation for cracking 1

equation for isomerisation 1

state that reforming converts chains into rings/cyclic compounds 1

equation for reforming (balanced with H2 could score two marks) 1

oil is finite/non-renewable 1

ethanol is renewable/sustainable 1

from plants/crops/sugar cane/sugar beet/glucose/sugar/ fermentation 1

C2H5OH  3O2  2CO2  3H2O 1

QWC

 organise relevant information clearly and coherently, using specialist
vocabulary when appropriate (minimum of 4 from cracking/
isomerisation/ reforming/ renewable/ feedstock/
finite/fermentation/non-renewable/sustainable/zeolite/bimetallic
catayst/ etc )

 reasonable spelling, punctuation and grammar throughout 1

[11]

**8.** (i) reaction carried out at 298K and 1 atm pressure (or other relevant

units) (1) 1

(ii) enthalpy change when 1 mole (1)

(of substance) is burnt in excess oxygen (1) 2

(iii) 4CO2  5H2O at lower energy than reagents (1)

*E*a marked correctly (1)

H marked correctly (1) 3

[6]

**9.** (i) 4C(s)  5H2(g)  C4H10(g)

reagents and products (1)

state symbols (1) 2

(ii) 4C  5H2  C4H10

4(394) 5(286) 2877

4CO2 5H2O

cycle (1)

correct values (1)

answer (1)

X – 2877 = 4(-394)  5(-286)

X = -129 (kJ mol−1) 3

[5]

**10.** if the **conditions** on a system in **equilibrium** are changed (1)

the equilibrium moves to try to minimise the effects of the change (1)

[2]

**11.** (i) time less (1)

Ea lowered (1) 2

(ii) time less (1)

more collisions/ particles **exceed Ea** (1) 2

(iii) time more (1)

 particles are **further apart** and therefore less (frequent) collisions (1) 2

[6]

**12.** (i) no effect because it only increases rate of reaction (1) 1

(ii) moves to LHS/ more N2 and H2/ less NH3 (1)

**forward** reaction is exothermic (1) 2

(iii) moves to LHS / more N2 and H2/ less NH3 (1)

fewer moles on RHS (1) 2

[5]

**13.** (a) C6H14 1

(b) (i) boiling point increases with increase in MR/molecular formula/N of
carbon atoms/chain length 1

(ii) more intermolecular forces/electrons/surface area/

 surface interactions/van der Waal forces 1

(iii) 120  130 C 1

[4]

**14.** (i) C9H20  C7H16  C2H4 1

(ii) C2H4  H2O  C2H5OH 1

temperature > 100 C/ steam 1

phosphoric acid (catalyst) 1

[4]

**15.** (a) (i) 1



(ii) 85 98 C 1

 2

(b)



(c) more efficient fuel/better fuel/ higher octane number/reduces
knocking/more volatile/lower boiling points/burn better/burn
more easily/quicker  1

[5]

**Examiners Report**

**1.** Most candidates coped well with this and scored all three marks.

 Part (i) was generally well answered. However, a substantial number of candidates still explain what is meant by a nucleophile as its “love of protons”. Nucleophiles and electrophiles should be defined in terms of movement of electron pairs.

In (ii), the understanding of mechanisms is improving and many successfully tracked the movement of electrons through the reaction. However, the response was often centre-specific such that all candidates from a particular centre either answered this very well or very badly. In order to score full marks the curly arrow had to start and finish at the correct points.

 Part (i) provided easy marks for most.

In (ii), many struggled with the skeletal formulae of propan-1-ol and propan-2-ol.

This was in contrast to the ease with which candidates answered Q1(d). Propan- 1-ol was particularly challenging with many drawing the skeletal formula of ethanol instead of the correct structure.

 Part (i) was straightforward for most.

In (ii), the naming of polymers still proves to be difficult.

Part (iii) was much better answered with a substantial number drawing the correct repeat units.

**2.** (a) In (i), the structure of prop-2-en-1-ol was well answered but many drew the aldehyde group in acrolein with CO rather than C = O.

(b) Part (i) proved to be surprisingly difficult with very few scoring both marks.
In (ii), many struggled despite the formula of both reagent and product being given at the start of the question.

**3.** This was generally well answered with most candidates finding infra-red spectroscopy straightforward

**4.** Part (i) was a difficult question but it was very pleasing to see the number of correct responses.

In (ii), there were some really pleasing answers and it is pleasing to see so many candidates able to apply their knowledge to unfamiliar situations.

**5.** Part (i) was generally well answered with most scoring the mark.

In (ii), as with Q2(b), the understanding of mechanisms is much improved with responses very centre-specific.

**6.** Many simply drew any isomers of C3H6Br2 and often repeated

1,3-dibromopropane. Two marks out of three were very common.

**7.** Although taken directly from the specification (Assessment Outcome 5.2.6 (d)), this part was very poorly answered and it appeared to be unfamiliar to very many students. A substantial number identified silver nitrate as the reagent but failed to clearly mention the differential rates of appearance of the precipitate. Many students recognised that the rate of hydrolysis for the halogenoalkanes varied from chloro- to iodo-, but it was uncommon to see responses that considered how the rates differed and which was faster. Many candidates did not write any equations and many tried to incorporate the nitrate ion and/or the Ag+ ion into the organic product. Few, if any, managed to correctly state the correct conditions and procedure.

**8.** Many failed to comprehend the first part of this section and did not use the evidence from Midgley’s demonstration to predict appropriate properties. The understanding of why a gas put out a flame was very poor.

In the second part many did not read the question correctly and mentioned CCl2F2 as a refrigerant or coolant. Candidates often suggested a use of CFCs but then failed to justify this with a reason. Others simply could not identify the uses of CFCs. Many candidates mentioned that CFCs, such as CCl2F2, destroy the ozone layer, which was not relevant to the question. Better examination technique could have resulted in an extra 3 or 4 marks for many candidates.

**9.** (a) In (i), most candidates clearly knew how to solve this type of problem, and many gained full marks. Common mistakes included incorrect multipliers for numbers of bonds (eg. 2  OH) and also reversing the signs for the bonds broken and bonds made. Answer: 577 kJ mol1.
In (ii), a significant number of candidates did not attempt this part. Of those who gave an answer, common incorrect responses included dividing (i) by 1000 or simply repeated their answer to (i). If the candidate realised the basis of the question, the answer was generally correct. Answer: 18 kJ.

(b) Since the question required candidates to **suggest** why hydrazine is preferable to ammonia for use as a rocket fuel, this gave an opportunity to apply chemical principles, so that a variety of answers were acceptable. Some logical answers were seen but others confused the signs of the enthalpy changes or ignored the information given in the question that the products of the reaction and the energy released per gramme on combustion were the same.

**10.** Most candidates knew the basic idea of le Chatelier’s principle and, although some suggested that the change in condition made could be completely ‘cancelled out’, this was less common than has been seen in previous years.

Candidates are clearly learning to use the words that are considered acceptable to express this idea.

**11.** As already discussed, a significant number of candidates did not actually describe what would be **seen**. This was a pity since often explanations showed good understanding of what was happening to the equilibrium position. It should be noted that it is not acceptable for candidates to state ‘it is an exothermic reaction’ without saying that this is in the forward direction since clearly the reverse direction is endothermic. A small but significant number lost marks by stating or implying that, once shifted to the left, the equilibrium would then move to the right again to ‘restore itself’ or ‘oppose the change’. A small number of candidates misinterpreted the question completely and discussed rates of reaction.

**12.** (a) Most candidates knew and correctly defined the enthalpy change of combustion, although a few defined it in terms of energy ‘required’. A significant number made reference to standard conditions. This was ignored as it was clearly unnecessary in the definition as requested.

(b) While the majority of candidates knew how to write the equation and scored one mark, a large number failed to balance it properly with 5O2 being common. Very few, however, scored the second mark for correct state symbols. Most omitted them completely and, of those who did write them, many gave propan-1-ol as (aq) and/or water as (g).

(c) In (i), most candidates clearly appreciated the need to use the formula: *Q = mcT* and many scored both marks. However, a large number incorrectly used the mass as 0.100 g. A few candidates did not recognise that the calculated value was in J and therefore did not change this to kJ in quoting the final answer. Answer: 2.68 kJ

 In (ii), explanations were often totally absent but credit could be given to correct answers. Reasonable approximations of significant figures were allowed but candidates should recognise that 1.67 could not reasonably be approximated to 1 or 2 in this context. Answer: 0.00167

 In (iii), candidates were given credit for dividing (i) by (ii), even if one or both of these were incorrect numerically. A significant number of candidates however failed to attempt this part of the question. Answer: 1608 kJ mol–1

(d) Many acceptable reasons were seen and credited, the most common being heat loss, heat going into equipment rather than the water, incomplete combustion and the lack of standard conditions. However a very large number of candidates suggested errors that amounted to experimental incompetence, such as incorrect readings or impurities in materials. These were not accepted.

**13.** Most candidates knew that a catalyst speeds up a reaction but a significant number stated or implied that it did not take part in the reaction. This meant that they were given one mark.

**14.** (a) In (i), it was encouraging to note that most candidates could balance this equation, even though large or non-integral values are involved. Some equations, showing various forms of incomplete combustion, were given.

 In (ii), most candidates realised that atmospheric gases were responsible for the formation of NO but a significant number suggested impurities in the fuel or some type of incomplete combustion.

(b) In (i), two acceptable metals were usually seen but a surprising number of other metals were given. These included iron, lead, aluminium, cobalt, potassium and rubidium.

 In (ii), many candidates quoted a ‘text book’ account of how a heterogeneous catalyst works. Others confused ‘absorbed’ with ‘adsorbed’, became very concerned with the nature of honeycombs or merely discussed the function of catalysts, rather than how the heterogeneous one actually achieves the lowering of the activation energy.

 (iii) Only the most able candidates were able to pick out and use the correct substances from those given.

(c) Many candidates ignored ‘further reactions occur’ and quoted CO. Some however realised the significance of the emission of these substances on the environment.