AS Chemistry

Unit 2 Practice Exam Questions – Test 3

**1.** (a) (i) reaction 1 1

(ii) reaction 4 1

(iii) reaction 3 1

(b) (i) lone pair/electron pair donor 1



Correct dipole 1

Curly arrow from the O in the OH- to C in the CH2 1

Curly arrow to show movement of bonded pair in the C-C*l* bond 1

C*l*- as a product 1

(c) (i) same molecular formula , different structure/arrangement of atoms. 2

(same formula, different structure.)

(ii) 2



(d) (i) addition, (not additional) 1

(ii) poly(propene)/ polypropene/ polypro-1-ene, polypropylene 1

(iii) 1



[15]

**2.** (a) (i) prop-2-en-1-ol CH2CHCH2OH must show the C=C double bond 1

**acrolein**



**mus**t clearly show the aldehyde group and the C=C

1

(ii) alkene/C=C double bond 1

(b) (i) acidified /H+ 1

dichromate/Cr2O7 2- 1

(ii) CH2CHCH2OH/ C3H6O/ C3H5OH  [O]  CH2CHCHO/ C3H4O/  
 C2H3CHO  H2O  
 not CH2CHCOH 1

[6]

**3.** acrylic acid 1

approx 1700 cm-1 (range 1650  1750 ) indicates C=O 1

approx 3000 cm-1 (range 2500- 3300) indicates O-H 1

**not** 3230  3550 cm-1

[3]

**4.** (i) CH2CHCH2OOCCHCH2 /(C6H8O2) 1

H2O 1

(ii) 2



1 mark if the ester group, 1 mark for the rest of the molecule.

COO/CO2 without displaying the ester, they can still get 1 mark.

[4]

**5.** (i) decolourises/not clear/not discolours 1

(ii)



curly arrow from C=C to Br+ 1

dipole on Br-Br **and** curly arrow showing movement of bonded  
pair of electrons 1

correct intermediate/carbonium ion/carbocation **and** curly arrow  
from Br- to C+ 1

1, 2-dibromopropane as product 1

[5]

**6.** CH3CBr2CH3 1

CH3CHBrCH2Br 1

CH3CH2CHBr2 1

(CH3CHBrCH2Br has a chiral centre, hence optical isomers of  
1, 2-dibromopropane are acceptable but must be drawn with  
‘wedge-shape’ bonds and be non-superimposable mirror images)

[3]

**7.** Essential marks:

Order RIRBrRC*l* /owtte 1

reason for the order C-I bond weakest/length/C-C*l* bond strongest and  
 mention/intermolc forces loses the mark 1

an equation Ag+  X-  AgX (solid or ppt) or an equation for  
 hydrolysis/using OH- or H2O 1

max = 3

Two possible methods of monitoring the reaction

**Method 1** **Method 2**

AgNO3 AgNO3 1

Ethanol & Waterbath/ NaOH/OH- 1

/hydroxide

temp 40  80C & neutralise with HNO3

not heat/not bunsen

relative rate of relative amount of  
precipitation precipitation 1

[6]

**8.** Properties:

Non-toxic/harmless 1

non-flammable 1

any two from: 2

(propellant in) aerosols because it is volatile/ unreactive/ non-toxic/ easily

compressed

blowing polystyrene because it is unreactive

dry cleaning because it is a good solvent for organic material

degreasing agent because it is a good solvent for organic material

fire extinguishers because it is non-flammable

QWC

 reasonable spelling, punctuation and grammar throughout

[4]

**9.** (a) (i) bonds broken

(N  N)  (O == O)  (N  H) = 163  497  4(390) = 2220 (kJ mol-1) (1)

bonds made

(N  N)   = 945  4(463) = 2797  (1)

broken H is ve and made H is ve (1)

enthalpy of reaction  577  (1) 4

(ii)  1

(b) N-N bond is weak/ higher Ea for ammonia/ rate too slow for ammonia/  
too much energy to break bonds in ammonia / hydrazine is liquid/ do  
not need pressurised containers/ more moles/ lots of gas produced  
by hydrazine/ more energy per mole produced by hydrazine (1) 1

[6]

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

the equilibrium moves to minimise the effects of the change/

counteract/ resist/ oppose the change (1)

[2]

**11.** (i) becomes brown/ darker/ colour more intense (1)

moves towards LHS/ towards NO2 (1)

**forward** reaction is exothermic/ **reverse** reaction is endothermic (1) 3

(ii) becomes less brown/ pale/ colourless (1)

moves towards RHS/ towards N2O4 (1)

fewer moles on RHS (1) 3

[6]

**12.** (a) (enthalpy change) when 1 mole of substance/ element/ compound (1)

NOT energy needed

is completely burnt (1) 2

(b) C3H7OH(l)  4½ O2(g)  3CO2(g)  4H2O(I)

correctly balanced equation (1)

state symbols (species must be correct) (1) 2

(c) (i) H = mcT (1)

H = 50  4.18  12.8 = 2675 (J) = 2.68 (kJ) (1) 2

ignore sign

(ii) Mr propan-1-ol = 60 (1)

number moles = 0.00167 (1) 2

(iii) H =  (1) 1

(iv) heat losses (1)

thermal capacity of beaker ignored (1)

conditions were non-standard (1)

combustion could be incomplete (1)

propan-1-ol evaporates (1)

water evaporates (1) 2

[11]

**13.** catalyst alters rate of reaction/ lowers Ea (1)

remains unchanged **after** the reaction/ is not changed at the **end** of the reaction  
BUT negated by does not take part in reaction (1)

[2]

**14.** (a) (i) C8H18  121/2O2  8CO2  9H2O

reagents and products (1)

balancing (1) 2

(ii) from nitrogen in air and oxygen (1) 1

(b) (i) any two from Pt/ Rh/ Pd 1

(ii) adsorbed (1)

bonds within molecule weakened (1)

desorbed/ description (1) 3

(iii) CO  NO  1/2N2  CO2

reagents and products (1)

balancing (1) 2

(c) ozone/ NO2/ nitric acid (1) 1

[10]

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.