AS Chemistry

Unit 2 Practice Exam Questions – Test 7

**1.** (i) (free radical) substitution 1

(ii) 1-bromohexane, 2-bromohexane and 3-bromohexane 3

[4]

**2.** (a)



curly 1

dipoles shown correctly on the Br–Br and curly arrow from the Br–Br 1

bond towards the Br

correct intermediate shown 1

curly arrow from the lone pair or the negative charge on the Br  to the 1

C

(b) (i) Hs are diagonal to each other in the *trans/* 1

difference clearly shown in a diagram

(ii) (the product is saturated hence) there is no restricted rotation/single 1

bonds allow rotation/because C=C prevents rotation

[6]

**3.** (i) 2



(ii) either (2-)methylpropan-1-ol or (2-)methylpropan-2-ol 1

[3]

**4.**



Minimum  must display/show C=C

[3]

**5.** (a) (i) H+ 1

Cr2O7 2- 1

(ii) Orange to green/black/blue 1

(b) (i) contains a C=O/aldehyde, ketone, carboxylic acid and ester/ 1

carbonyl/carbonyl in an aldehyde

(ii) does **not** contain a OH/ (hydrogen bonded in a) carboxylic acid 1

(iii) distillation (no mark) **because** distillation allows loss of volatile 1

components /removes butanal from oxidising mixture

prevents formation of RCOOH/ partial oxidation would be achieved 1

or reverse argument for reflux not being used

in that reflux prevents loss of volatile components

hence complete oxidation would be achieved/RCOOH would be formed  


[7]

**6.** Recognises that either a catalyst or high temperature (heat is not 1

sufficient) is required

**cracking** suitable balanced equation 1

**reforming** equation or statement indicating formation of a ring/cyclic

compound

suitable balanced equation with H2 1

(balanced equation showing formation of a ring scores both marks) 1

**isomerisation** suitable balanced equation

The **processed products** are: 1

 used in fuels/used in petrol

 better /more efficient fuels/increase octane number/rating

 alkenes (from cracking) produce polymers/alcohols

 H2 used for Haber process/fuels/hydrogenation of oils 3

QWC SPAG  look for two complete sentence that present a 1

coherent argument

[9]

**7.** (i) C6H10 1

(ii) C3H5 / ecf to (i) 1

(iii) Mr of cyclohexene = 82 1

 C = (72/82)  100 = 88 1

87.8 gets 1 mark

ecf to (i) and (ii) for both marks

Alternative calculation based on empirical formula:

Mass of empirical unit = 41,  C = (36/41)  100 = 88

[4]

**8.** H2 1

Ni/Pt/Pd (catalyst) 1

[2]

**9.** (a) (i) 1



(ii) H2SO4/Al2O3/(hot) pumice/H3PO4 1

(H2SO4(aq) or dil H2SO4 loses the mark)

(iii) 1



C6H11OH / C6H12O  C6H10  H2O

(b) (i) 1



(ii) 2



[6]

**10.** (i) (enthalpy change) when 1 mole of compound is formed 

from the constituent elements  2

(ii) 6C(s)  7H2(g)  C6H14(l)

correct formulae and balancing 

tate symbols  2

(iii) temperature 25C/ 298K/ a stated temperature (if justified)

pressure 1 atm/ 100 kPa/ 101 kPa  1

[5]

**11.** diagram to show

lines to show energy level at start above that at end of reaction 

*H* labelled between reactants and products 

*E*a labelled from reactants to top of energy ‘hump’ 

[3]

**12.** correct Hess’ cycle 

*x*  890 = 572  394 

*x* = 76 (kJ mol–1) 

[3]

**13.** (i) 1652/4 = 413 (kJ mol–1)  1

(ii) (CC)  6 (CH) = 2825 

(CC) = 2825  6(413) = 347 (kJ mol–1)  2

[3]

**14.** (a) when the conditions on a reaction in **equilibrium** are **changed/ disturbed** 

the (equilibrium) moves in the direction to minimise the effects of the

change  2

(b) (i) equilibrium moves to the LHS/ more X2 and Y2 are produced 

more moles (of gas)/ particles on LHS  2

(ii) rate becomes less as there are less particles in a unit volume/ concentration

less/ more space between particles 

therefore there are less (frequent) collisions  2

(c) (i) 16–17   1

(ii) as the temperature increases the conversion decreases 

(equilibrium) has moved to LHS/ has moved in endothermic direction  2

(d) (i) increases 

because more collisions exceed (lowered) Ea/ because the catalyst provides an

alternative route with a lower activation energy  2

(ii) no change 

forwards and reverse rates increased by **same** amount  2

[13]

**Examiners Report**

**1.** (i) Most scored the mark but a substantial minority failed to score.

(ii) This was generally poorly done. Very many gave branched isomers as part of their answer.

**2.** (a) Candidates were well prepared and many scored full marks for the mechanism.

(b) (i) This part was very straightforward with almost all scoring the mark.

(ii) This part was more demanding and many failed to express themselves clearly and concisely.

**3.** The majority scored both marks for drawing the isomers, although a substantial number drew the same isomer twice whilst others re-drew either butan-1-ol or butan-2-ol, or both.

Many lost a mark by making careless errors in the naming of their isomer.

**4.** Most score well with 2 out of 3 being the most common mark. Very many gave methylpropene as a possible isomer and many failed to spot that but-2-ene has *cis* and *trans* isomers.

**5.**(a) This was easy recall and many scored all three marks, but many lost a mark by omitting the need for an acid or by quoting an incorrect oxidation state for the dichromate.

(b) Parts (i) and (ii) were straightforward but many failed to appreciate how the choice of apparatus can affect the final product. Only the most able candidates scored both marks.

**6.** This is a common extended writing question and many were well prepared for it.

Candidates should learn to take their prompts from the question. In their responses the examiners were looking for a balanced equation for each process, together with an indication of the industrial conditions followed by a clear statement of the usefulness of the products.

Most wrote suitable equations to illustrate cracking but many chose to crack butane into ethane and ethene and then went on to incorrectly state that the products were ‘used as petrol’.

Isomerisation is well understood and many illustrated the process by an equation using skeletal formulae, which is fine, but the equation still has to balance.

Reforming is less well understood. Often able candidates forgot to balance the equation and a substantial minority think that reforming is the reverse of cracking.

Few, if any, stated the usefulness of the hydrogen produced.

Most scored the quality of written communication mark.

**7.** This part was well answered with many scoring all four marks. Many lost a mark by not following the instructions in the question and failed to quote their answer to two significant figures.

A substantial number misread ‘cyclohexene’ and answered the question about cyclohexane.

**8.** This was generally well answered but it tended to be two or nothing.

**9.** (a) (i) This was well answered but a common mistake was to draw 1,2-dichlorocyclohexane.

(ii) This was well answered but strangely many quoted water as a suitable dehydrating agent.

(iii) Many simple errors cost candidates the mark.

(b) Able candidates coped well with this and scored either 2 or 3 of the available marks. Many carelessly lost a mark by drawing the same cyclohexadiene twice. Weaker candidates found it difficult to score any marks.

**10.** As noted above, this question was generally well answered although the inclusion of a calculation on bond enthalpies in a slightly different form did cause difficulty to some candidates.

(i) Most candidates had learnt this definition. Occasional errors seen included using 1 mole of elements or carrying out the reaction in the gaseous phase.

(ii) Apart from a small number of candidates who wrote an unrelated equation, most could give an equation using elements. Weaker candidates sometimes gave carbon as C6 and hydrogen as H or H14.

(iii) Most answers seen were correct or at least understandable. 289 K was given occasionally.

**11.** Most diagrams were correct. Candidates who drew a diagram showing an endothermic process were able to access the marks for Ea and *H*.

**12.** Not surprisingly candidates who drew correct cycles were most likely to complete this calculation successfully. It was obvious that nearly all candidates were familiar with the use of Hess’ Law to solve problems of this type.

Ans. 76 kJ mol–1.

**13.** Many candidates failed to recognise that bond enthalpies are defined as the energy needed to break the bond and are therefore positive. This meant that large numbers quoted a correct numerical value, but with a negative sign, in (i). If they went on to use their answer in (ii) this was credited as correct in this part.

Answers

(i) 413 kJ mol–1

(ii) 347 kJ mol–1.

**14.** (a) Although clearly there are many ways of stating le Chatelier’s principle, most candidates gave acceptable answers. In recent years there have been fewer responses that implied the change to the equilibrium conditions was completely nullified.

(b) Although the word ‘decrease’ was given in bold type, some candidates appeared to answer this question as though the pressure was increased. The examiners tried to credit such answers, in terms of the chemical logic shown, but it was sometimes difficult when the candidate did not actually state which change in pressure they were considering.

(c) Most candidates correctly read the percentage conversion from the graph and were able to interpret it to relate the lowering of the percentage conversion to the rise in temperature.

(d) (i) Nearly all candidates recognised that a catalyst increases the rate of a reaction and many explained how the catalyst achieves this effect. It was not however acceptable, for the second marking point, merely to state that the activation energy is lowered.

(ii) Some candidates seem to find difficulty with the idea that the rate can increase but that the percentage conversion can remain unaltered. However, many correct answers were seen and an increasing number of candidates were able to explain that this is because the rate of the forward and back reactions is affected equally.