AS Chemistry

Unit 2 Practice Exam Questions – Test 6

**1.** separation by (differences in) boiling point 1

C7H16  C4H10  C3H6 1

(i) Any of 1



(ii) C7H16  C7H14  H2 (or by structural formula) 1

(i) 2,2-dimethylpentane 1

(ii) 3-methylhexane, 3,3 dimethylpentane or (3)-ethylpentane in any unambiguous

form. 2

(iii) 2,2,3-trimethylbutane 1

(iv) if branched, difficult to pack/less surface interaction/less points of contact 1

less van der Waals’ forces/ less intermolecular bonds/less energy needed to boil 1

[10]

**2.** (i) C6H12O6 (aq)  2C2H5OH(*l*) or (aq)  2CO2(g) balanced equation 1

state symbols can be awarded only if equation shows C6H12O6 ,  
C2H5OH and CO2 1

(ii) anaerobic, aqueous, temp range 25  40C/warm to just above room temp 2

(iii) no more bubbles/gas/CO2 1

[5]

**3.** (a) (i) phosphoric acid/H+/sulphuric acid 1

(ii) lone/electron pair of electrons acceptor 1

(b) (i)



Step 1 curly arrow from -bond to H+ 1

Step 2 curly arrow from lone pair on the O- to C 1

Step 3 curly arrow from OH bond to O 1

(ii) catalyst … no marks because it is **not** consumed/used up in the  
reaction/owtte 1

[6]

**4.** CH3CH(OH)CH3  4½O2  3CO2  4H2O /C3H8O

(1 mark if correct formula for all four chemicals and 1 mark for correct balancing)

[2]

**5.** (a) 3-chloro(-2-)methylprop-1-ene/1-chloro(-2-)methylprop-2-ene 1

(b)



Backbone of 4 carbons and a reasonable attempt gets 1 mark.

2

[3]

**6.** (a) (i) uv/sunlight/high temperature (range 400  700 C) 1

(ii) C*l*2  2C*l* 1

C4H10  C*l*  HC*l*  C4H9/C4H9 1

C4H9/C4H9 C*l*2  C4H9C*l*  C*l* 1

(iii) any two free radicals from (a) (ii) 1

(iv) homolytic (fission) 1

(b) (i) 2, 3-dichlorobutane 1

(ii) 1



(iii) any dichlorobutane **except** 2,3-dichlorobutane. 1

[9]

**7.** **Bonding:** -bond formed by overlap of (adjacent) p-orbitals/-bond labelled on

diagram 1

diagram to show formation of the -bond 1



**Shape/bond angles:**

tetrahedral around the CH3 1

bond angle = 10928/ (109-110) 1

trigonal planar around each C in the C=C 1

bond angle = 120 (118-122) 1

**Cis-trans**

*cis* & *trans* correctly labelled eg but-2-ene 1

require a double bond because it restricts rotation 1

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

or groups 1

QWC Allow mark for well constructed answer and use of **three** terms like:

orbital, tetrahedral, trigonal, planar, rotation, spatial, stereoisomers,  
geometric 1

[10]

**8.** (a) (i) MgCO3(s)  2HC*l*(aq)  MgC*l*2(aq)  CO2(g)  H2O(l)

balancing 

state symbols  2

(b) (as the reaction proceeds) the concentration decreases 

(rate) of collision decreases 

reaction stops when all of one reagent is used up  3

(c) (i) sketch to show slower rate of production ie less steep (must not be

straight line) 

final volume the same but reached later  2

(ii) rate is slower

**because**

weak acid is partially ionised/ dissociated 

lower **concentration** of H+ in weak/ higher **concentration** of H+ in

strong/ HC*l*  2

[9]

**9.** C3H8  5O2  3CO2  4H2O

formulae 

balancing 

ignore state symbols

[2]

**10.** (enthalpy/ energy/ heat change) when 1 mole of substance/

element/ compound  (NOT absorbed)

is completely burnt/ burnt in excess oxygen 

under standard conditions ( if conditions stated they must be

correct) 

[3]

**11.** any two from

**rate** of forward reaction = **rate** reverse reaction 

macroscopic properties remain constant/ concentrations

remain constant 

closed system needed  2

(i) a substance that alters the rate of a reaction without being

used up /

a substance that lowers the activation energy (for a reaction)

by providing an alternative route  1

(ii) catalyst is in the same state/ phase as reactants  1

(iii) H+  1

(iv) they alter the rate of the forward and the reverse reaction **by**

**the same amount**  1

[6]

**12.** (i) axes labelled y as number/ fraction/  of molecules/ particles

and x as energy/ enthalpy/ velocity/ speed 

correct shape to include origin, hump and position wrt x axis 2



(ii) two vertical lines **drawn** both to the RHS of hump (at least

one labelled *Ea*) (labels reversed cannot score) 

greater proportion of collisions have energy greater than *Ea*/

more molecules exceed *Ea*  2

[4]

**13.** (a) pressure 50  1000 atm 

temperature 200  600C  2

(b) **rate** 9

(increased) pressure increases rate because molecules are

closer together/ more concentrated 

(increased) temperature increases rate because molecules

are moving faster/ have more energy 

**equilibrium**

increased pressure pushes equilibrium to RHS  because

fewer (gas) moles/ molecules on RHS 

increased temperature pushes equilibrium to LHS 

because (forward) reaction is exothermic 

**compromise**

if temperature is **too** high, low yield 

if temperature is **too** low, slow rate 

if pressure is too high, increased costs/ safety issues 

[11]

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.