

# MARK SCHEME

# GCSE

## CHEMISTRY

## AQA - TRIPLE SCIENCE

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C10 - TEST 6  
USING RESOURCES  
Advanced

## Mark schemes

1.

(a) cool

1

to  $-34\text{ }^{\circ}\text{C}$

*allow temperatures below  $-34\text{ }^{\circ}\text{C}$  but above  $-196\text{ }^{\circ}\text{C}$*

1

(b) recycled (to the reactor)

1

(c)  $825 \times \frac{2}{3}$

1

= 550 ( $\text{dm}^3$ )

1

*an answer of 550 ( $\text{dm}^3$ ) scores 2 marks*

(d) a lower pressure would decrease the equilibrium yield

1

a lower temperature would make the reaction too slow

1

(e) nitrogen / N

1

(f) **B** and **C**

1

contain nitrogen, phosphorus and potassium

1

(g) **(B)**

any **two** from:

- more stages
- uses more energy
- uses more raw materials
- takes longer

*allow converse for C*

2

**[12]**

2.

(a) any **two** from:

- heat water / make steam / boil water **or** heat / steam used in stage 1 or from stage 3
- carbon dioxide from stage 3 used in stage 7 /to make urea
- nitrogen and / or hydrogen recycled
- ammonia and / or carbon dioxide recycled  
*allow unreacted material / gas recycled from stage 5 (to 4)*  
*allow unreacted material / gas recycled from stage 8 (to 7)*  
*NB: if neither of the last two points are awarded unreacted material recycled = 1 mark*

2

(b) (i) increase yield

because (forward) reaction is exothermic

*ignore references to rate*

1

*allow because (forward) reaction gives out heat*

1

(ii) increase yield

*ignore references to rate*

1

because more (gaseous) reactant molecules than (gaseous) product molecules

*accept because greater volume on the left than the right*

1

(c) 76.9 - 77

*correct answer gains 2 marks with or without working*

*allow 77 **or** 76.923...*

*allow 76 **or** 0.77 **or** 0.76923 for 1 mark*

*if answer incorrect allow 1 mark for **either***

$$\frac{60}{\text{attempt at total } M_r \text{ of all reactants}} \times 100$$

**or**

$$\frac{\text{attempt at total } M_r \text{ of area}}{78} \times 100$$

2

[10]

3.

- (a) (i) many ethene / molecules / monomers  
*accept double bonds open / break*

1

join to form a long hydrocarbon / chain / large molecule  
*accept addition polymerisation*  
*ignore references to ethane*  
*correct equation gains 2 marks*

1

- (ii) (can be deformed but) return to their original shape (when heated or cooled)  
*ignore 'it remembers its shape'*

1

- (iii) cross links / extra bonds in PEX  
*accept inter-molecular bonds*  
*ignore inter-molecular forces*

1

molecules / chains in PEX are held in position  
*accept rigid structure*

1

molecules / chains in PEX unable to slide past each other / move  
*it = PEX throughout*

1

(b) any **four** from:

- less (hydrocarbon) fuels used  
*allow less energy*
- less / no electrical energy used  
*allow no electrolysis*
- reduce carbon / carbon dioxide emissions  
*allow less global warming*
- reduce / no pollution by sulfur dioxide / acid rain
- continuous process  
*allow less / no transportation*
- conserve copper which is running out or only low-grade ores available
- reduce the amount of solid waste rock that needs to be disposed  
*allow less waste*
- reduce the need to dig large holes (to extract copper ores)  
*allow less mining*  
*ignore costs / sustainability / non-renewable*

4

[10]

4.

(a) (i) 78-80%

1

(ii) proteins

*accept amino acids*

1

(b) (i) natural gas

*accept methane (CH<sub>4</sub>)*

*accept water (H<sub>2</sub>O)*

1

(ii) carbon dioxide

1

(c) (i) N<sub>2</sub> + H<sub>2</sub>

1

correct balancing 1 + 3 → 2

*award only if reactants are correct*

1

(ii) iron

*accept Fe*

1

- (iii) at low temperatures rate of reaction is too slow  
*accept very few collisions at low temperatures*  
*accept converse*

particles need enough (activation) energy to react  
*accept particles need enough energy for bonds to break*  
*accept converse*

1

- (d) all three covalent bonds displayed correctly as electron pairs

1

two lone electrons displayed not necessarily as a pair

1

[11]

5.

- (a) (i) natural gas

*allow fossil fuels / biogas generator*

1

- (ii) air contains oxygen

1

this would react with / oxidise the hydrogen

*allow this would react with / oxidise the iron*

*ignore nitrogen*

1

- (iii) cooled

1

ammonia condenses / liquefies (so can be separated)

1

nitrogen and hydrogen (remain as gases and) are returned to the reactor

*allow recycled*

1

- (b) (i) 200 °C **and** 1000 atmospheres

1

- (ii) the reaction is reversible

*allow stated as equilibrium or forward / backward reaction anywhere*  
*in answer*

1

forward reaction is exothermic so increased temperature lowers the yield of ammonia

*allow converse*

1

a lower temperature would decrease rate of reaction

*allow converse*

1

a higher pressure would increase the yield of ammonia because the forward reaction produces the least number of (gaseous) molecules / moles

*allow converse*

1

higher pressures would involve high cost / energy

1

*ignore risk / explosion*

**[12]**