

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International GCSE (9–1)

Centre Number

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Candidate Number

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Monday 20 January 2020

Afternoon (Time: 1 hour 15 minutes)

Paper Reference **4CH1/2CR**

Chemistry

Unit: 4CH1

Paper: 2CR

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Information

- The total mark for this paper is 70.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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The Periodic Table of the Elements

1	2	3	4	5	6	7	0																																																																																																																																																																																																							
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 P phosphorus 15	16 O oxygen 8	17 Cl chlorine 17	18 Ar argon 18																																																																																																																																																																																																					
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27	30 Ni nickel 28	31 Cu copper 29	32 Zn zinc 30	33 Ga gallium 31	34 Ge germanium 32	35 As arsenic 33	36 Se selenium 34	37 Br bromine 35	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Sn tin 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54																																																																																																																																																																													
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	58 Hf hafnium 72	59 Ta tantalum 73	60 W tungsten 74	61 Re rhenium 75	62 Os osmium 76	63 Ir iridium 77	64 Pt platinum 78	65 Au gold 79	66 Hg mercury 80	67 Tl thallium 81	68 Pb lead 82	69 Bi bismuth 83	70 Po polonium 84	71 At astatine 85	72 Rn radon 86	73 Fr francium 87	74 Ra radium 88	75 Ac* actinium 89	76 Rf rutherfordium 104	77 Db dubnium 105	78 Sg seaborgium 106	79 Bh bohrium 107	80 Hs hassium 108	81 Mt meitnerium 109	82 Ds darmstadtium 110	83 Rg roentgenium 111	84 U uranium 92	85 Np neptunium 93	86 Pu plutonium 94	87 Am americium 95	88 Cm curium 96	89 Bk berkelium 97	90 Cf californium 98	91 Es einsteinium 99	92 Fm fermium 100	93 Mendelevium 101	94 Nobelium 102	95 Lr lawrencium 103	96 Rf rutherfordium 104	97 Db dubnium 105	98 Sg seaborgium 106	99 Bh bohrium 107	100 Hs hassium 108	101 Mt meitnerium 109	102 Ds darmstadtium 110	103 Rg roentgenium 111																																																																																																																																																														
Elements with atomic numbers 112-116 have been reported but not fully authenticated																		112 Cn copernicium 112	113 Nh nihonium 113	114 Fl flerovium 114	115 Mc moscovium 115	116 Lv livermorium 116	117 Ts tennessine 117	118 Og oganeson 118	119 Uue unbinilium 119	120 Uub unbinilium 120	121 Uut ununilium 121	122 Uuq ununquadium 122	123 Uup ununpentium 123	124 Uuq ununquadium 124	125 Uup ununpentium 125	126 Uuq ununquadium 126	127 Uup ununpentium 127	128 Uuq ununquadium 128	129 Uup ununpentium 129	130 Uuq ununquadium 130	131 Uup ununpentium 131	132 Uuq ununquadium 132	133 Uup ununpentium 133	134 Uuq ununquadium 134	135 Uup ununpentium 135	136 Uuq ununquadium 136	137 Uup ununpentium 137	138 Uuq ununquadium 138	139 Uup ununpentium 139	140 Uuq ununquadium 140	141 Uup ununpentium 141	142 Uuq ununquadium 142	143 Uup ununpentium 143	144 Uuq ununquadium 144	145 Uup ununpentium 145	146 Uuq ununquadium 146	147 Uup ununpentium 147	148 Uuq ununquadium 148	149 Uup ununpentium 149	150 Uuq ununquadium 150	151 Uup ununpentium 151	152 Uuq ununquadium 152	153 Uup ununpentium 153	154 Uuq ununquadium 154	155 Uup ununpentium 155	156 Uuq ununquadium 156	157 Uup ununpentium 157	158 Uuq ununquadium 158	159 Uup ununpentium 159	160 Uuq ununquadium 160	161 Uup ununpentium 161	162 Uuq ununquadium 162	163 Uup ununpentium 163	164 Uuq ununquadium 164	165 Uup ununpentium 165	166 Uuq ununquadium 166	167 Uup ununpentium 167	168 Uuq ununquadium 168	169 Uup ununpentium 169	170 Uuq ununquadium 170	171 Uup ununpentium 171	172 Uuq ununquadium 172	173 Uup ununpentium 173	174 Uuq ununquadium 174	175 Uup ununpentium 175	176 Uuq ununquadium 176	177 Uup ununpentium 177	178 Uuq ununquadium 178	179 Uup ununpentium 179	180 Uuq ununquadium 180	181 Uup ununpentium 181	182 Uuq ununquadium 182	183 Uup ununpentium 183	184 Uuq ununquadium 184	185 Uup ununpentium 185	186 Uuq ununquadium 186	187 Uup ununpentium 187	188 Uuq ununquadium 188	189 Uup ununpentium 189	190 Uuq ununquadium 190	191 Uup ununpentium 191	192 Uuq ununquadium 192	193 Uup ununpentium 193	194 Uuq ununquadium 194	195 Uup ununpentium 195	196 Uuq ununquadium 196	197 Uup ununpentium 197	198 Uuq ununquadium 198	199 Uup ununpentium 199	200 Uuq ununquadium 200	201 Uup ununpentium 201	202 Uuq ununquadium 202	203 Uup ununpentium 203	204 Uuq ununquadium 204	205 Uup ununpentium 205	206 Uuq ununquadium 206	207 Uup ununpentium 207	208 Uuq ununquadium 208	209 Uup ununpentium 209	210 Uuq ununquadium 210	211 Uup ununpentium 211	212 Uuq ununquadium 212	213 Uup ununpentium 213	214 Uuq ununquadium 214	215 Uup ununpentium 215	216 Uuq ununquadium 216	217 Uup ununpentium 217	218 Uuq ununquadium 218	219 Uup ununpentium 219	220 Uuq ununquadium 220	221 Uup ununpentium 221	222 Uuq ununquadium 222	223 Uup ununpentium 223	224 Uuq ununquadium 224	225 Uup ununpentium 225	226 Uuq ununquadium 226	227 Uup ununpentium 227	228 Uuq ununquadium 228	229 Uup ununpentium 229	230 Uuq ununquadium 230	231 Uup ununpentium 231	232 Uuq ununquadium 232	233 Uup ununpentium 233	234 Uuq ununquadium 234	235 Uup ununpentium 235	236 Uuq ununquadium 236	237 Uup ununpentium 237	238 Uuq ununquadium 238	239 Uup ununpentium 239	240 Uuq ununquadium 240	241 Uup ununpentium 241	242 Uuq ununquadium 242	243 Uup ununpentium 243	244 Uuq ununquadium 244	245 Uup ununpentium 245	246 Uuq ununquadium 246	247 Uup ununpentium 247	248 Uuq ununquadium 248	249 Uup ununpentium 249	250 Uuq ununquadium 250	251 Uup ununpentium 251	252 Uuq ununquadium 252	253 Uup ununpentium 253	254 Uuq ununquadium 254	255 Uup ununpentium 255	256 Uuq ununquadium 256	257 Uup ununpentium 257	258 Uuq ununquadium 258	259 Uup ununpentium 259	260 Uuq ununquadium 260	261 Uup ununpentium 261	262 Uuq ununquadium 262	263 Uup ununpentium 263	264 Uuq ununquadium 264	265 Uup ununpentium 265	266 Uuq ununquadium 266	267 Uup ununpentium 267	268 Uuq ununquadium 268	269 Uup ununpentium 269	270 Uuq ununquadium 270	271 Uup ununpentium 271	272 Uuq ununquadium 272	273 Uup ununpentium 273	274 Uuq ununquadium 274	275 Uup ununpentium 275	276 Uuq ununquadium 276	277 Uup ununpentium 277	278 Uuq ununquadium 278	279 Uup ununpentium 279	280 Uuq ununquadium 280	281 Uup ununpentium 281	282 Uuq ununquadium 282	283 Uup ununpentium 283	284 Uuq ununquadium 284	285 Uup ununpentium 285	286 Uuq ununquadium 286	287 Uup ununpentium 287	288 Uuq ununquadium 288	289 Uup ununpentium 289	290 Uuq ununquadium 290	291 Uup ununpentium 291	292 Uuq ununquadium 292	293 Uup ununpentium 293	294 Uuq ununquadium 294	295 Uup ununpentium 295	296 Uuq ununquadium 296	297 Uup ununpentium 297	298 Uuq ununquadium 298	299 Uup ununpentium 299	300 Uuq ununquadium 300

1 H hydrogen 1

Key
relative atomic mass
atomic symbol
atomic (proton) number

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.
The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.



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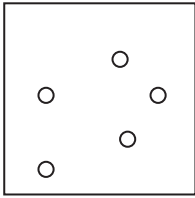


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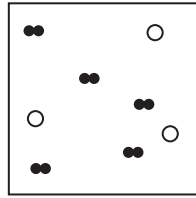
Answer ALL questions.

1 Substances can be classified as elements, mixtures or compounds.

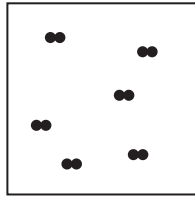
(a) Each box represents an element, a mixture or a compound.



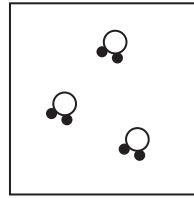
Box 1



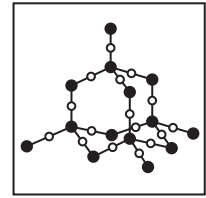
Box 2



Box 3



Box 4



Box 5

(i) Which box represents a mixture?

(1)

- A 1
- B 2
- C 3
- D 4

(ii) Which two boxes represent elements?

(1)

- A 1 and 2
- B 2 and 3
- C 1 and 3
- D 3 and 4

(iii) Explain why Box 5 represents a compound.

(2)

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(b) The Periodic Table contains all the known elements.

(i) How are the elements arranged in the Periodic Table?

(1)

- A increasing mass number
- B increasing number of neutrons
- C increasing number of protons
- D increasing reactivity

(ii) Elements in the same group have the same number of

(1)

- A electrons in the outer shell
- B electron shells
- C neutrons
- D protons

(Total for Question 1 = 6 marks)



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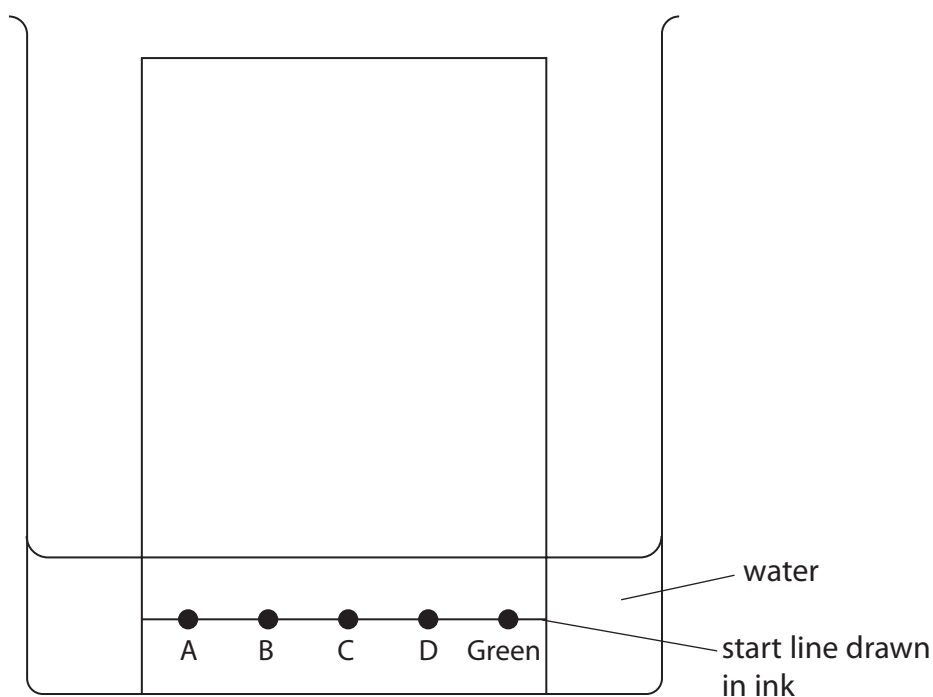
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2 Chromatography is used to analyse mixtures.

A student does a chromatography experiment to analyse the composition of green food colouring in sweets.

She places four known dyes, A, B, C and D, and the green food colouring on chromatography paper.

The diagram shows the student's apparatus at the start of her experiment.



- (a) The diagram shows that the student makes two mistakes when setting up her apparatus. State the two changes that the student should make so that her experiment works. (2)

1.....

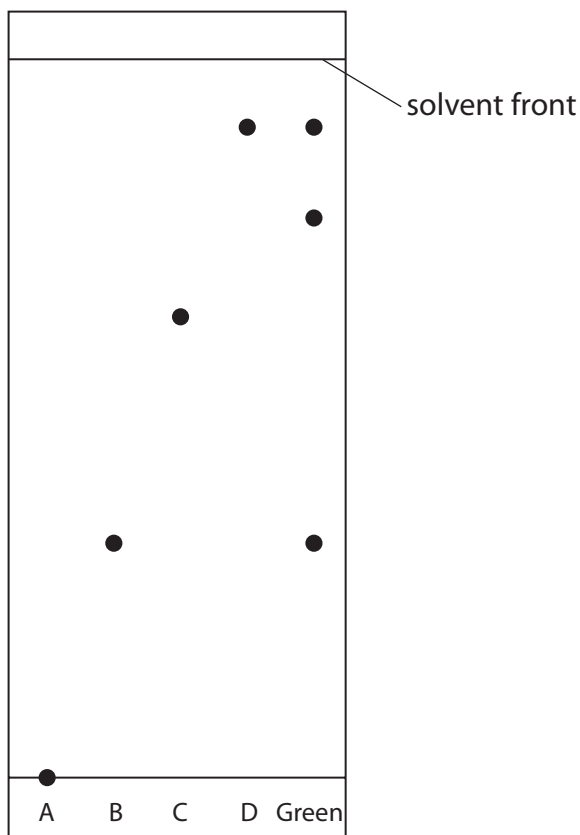
2.....



Turn over

(b) Another student does the chromatography experiment correctly.

The diagram shows her chromatogram at the end of the experiment.



(i) Explain what the chromatogram shows about the composition of the green food colouring.

(3)

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(ii) The distance between the start line and the spot for dye C is 6.2 cm.

Calculate the R_f value of dye C.

(3)

R_f value =

(iii) Suggest why dye A does not move.

(1)

(Total for Question 2 = 9 marks)

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3 Solutions of silver nitrate and potassium chloride react together to make the insoluble salt, silver chloride.

A student uses this method to prepare a sample of silver chloride.

Step 1 add 25 cm^3 of silver nitrate solution to a conical flask

Step 2 add potassium chloride solution to the flask

Step 3 filter off the silver chloride

(a) What term is used for this reaction?

(1)

- A neutralisation
- B precipitation
- C redox
- D thermal decomposition

(b) Give two more steps that will produce a pure, dry sample of silver chloride.

(2)

Step 4.....

Step 5.....

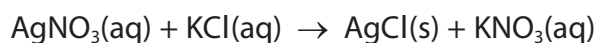
(c) Acidified silver nitrate solution is used to test for chloride ions.

Give a reason why hydrochloric acid is not used to acidify silver nitrate solution.

(1)



- (d) The chemical equation for the reaction between solutions of silver nitrate and potassium chloride is



A student adds an excess of potassium chloride solution to 25.0 cm³ of 0.100 mol/dm³ silver nitrate solution.

Calculate the maximum mass of silver chloride, in grams, that can be produced.

[M_r of AgCl = 143.5]

(2)

mass = g

(Total for Question 3 = 6 marks)



4 This question is about the metal, lead.

(a) Explain why metals, such as lead, are malleable.

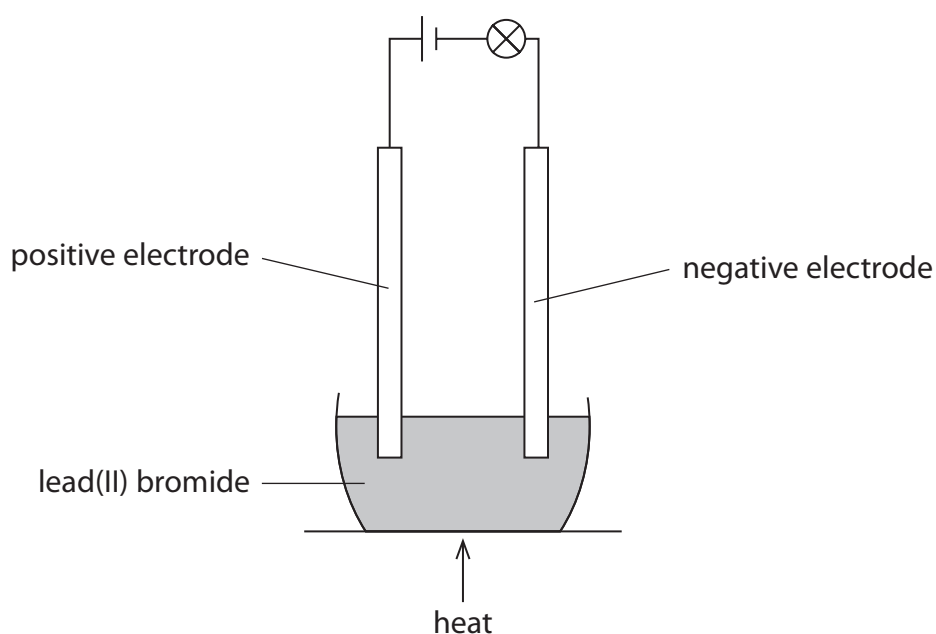
(2)

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(b) A teacher uses this apparatus in a fume cupboard to demonstrate the electrolysis of lead(II) bromide.



The lead(II) bromide is heated until it melts.

When the lead(II) bromide melts, the lamp lights.

One of the products of this electrolysis is lead.

(i) State why solid lead(II) bromide does not conduct electricity.

(1)

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(ii) Bromine is formed by the oxidation of bromide ions at the positive electrode.

Complete the ionic half-equation for the oxidation of bromide ions.

(1)



(iii) Explain why lead metal forms at the negative electrode.

(2)

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(iv) The teacher stops heating the mixture and allows it to solidify.

Suggest why the lamp stays alight.

(1)

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(Total for Question 4 = 7 marks)

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Turn over

5 This question is about Group 1 metals and their reactions.

(a) When lithium is added to water, bubbles of hydrogen gas are observed.

(i) Give two other observations that could be made.

(2)

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2.....
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(ii) Give the test for hydrogen gas.

(1)

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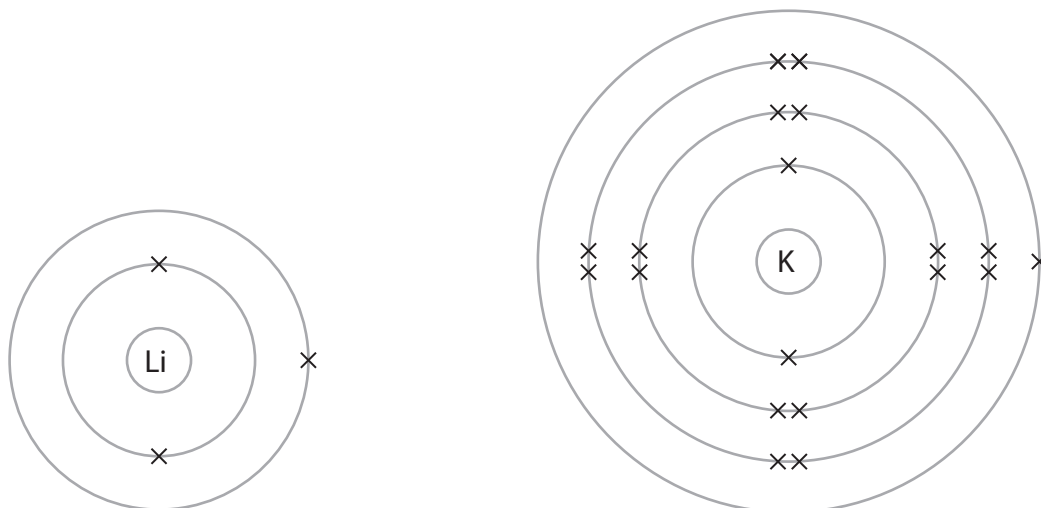
(b) (i) Give one observation that would be different if potassium is used instead of lithium.

(1)

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(ii) The diagram represents an atom of lithium and an atom of potassium.



Explain why potassium is more reactive than lithium.

(3)

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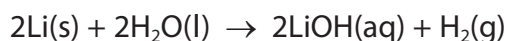
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Turn over

(c) The equation for the reaction between lithium and water is



(i) A mass of 0.500 g of lithium reacts with an excess of water.

Calculate the volume, in cm^3 , of hydrogen gas produced at rtp.

[molar volume of a gas at rtp = $24\,000\text{ cm}^3$]

Give your answer to three significant figures.

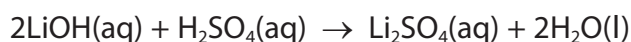
(3)

volume = cm^3

(ii) In a reaction between lithium and water, 150 cm^3 of lithium hydroxide solution is formed.

The lithium hydroxide solution is then completely neutralised by 24.85 cm^3 of 0.100 mol/dm^3 sulfuric acid.

The equation for the neutralisation is



Calculate the concentration, in mol/dm^3 , of the lithium hydroxide solution.

(3)

concentration = mol/dm^3

(Total for Question 5 = 13 marks)



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(ii) The rate of this reaction can also be increased by using a catalyst.

Explain how using a catalyst increases the rate of a reaction.

(2)

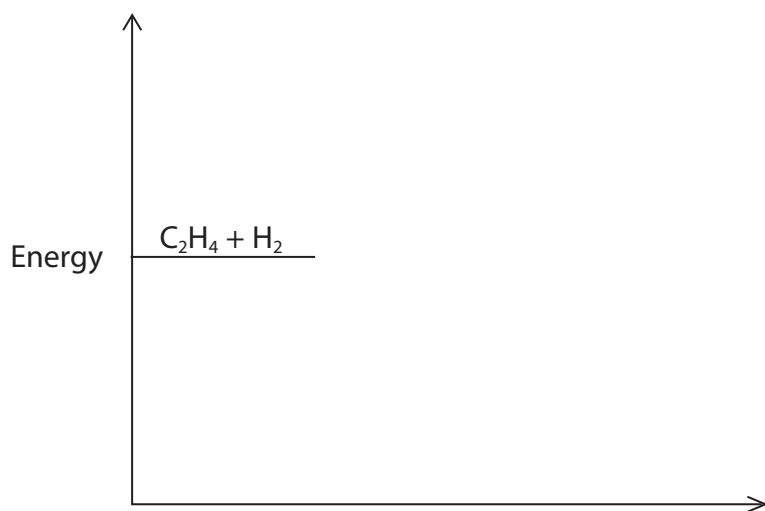
(iii) Give one other way that the rate of reaction between ethene gas and hydrogen gas can be increased.

(1)

(iv) The reaction between ethene and hydrogen is exothermic.

Complete the reaction profile diagram, including labels for the activation energy and the enthalpy change, ΔH .

(3)



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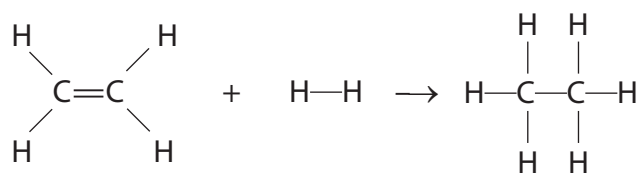


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(c) The reaction between ethene and hydrogen can be represented using displayed formulae.



Bond	Bond energy in kJ/mol
C=C	612
C—H	412
H—H	436
C—C	348

Use the bond energies in the table to calculate the enthalpy change, ΔH , in kJ/mol for this reaction.

(3)

$\Delta H = \dots\dots\dots$ kJ/mol

(Total for Question 6 = 15 marks)



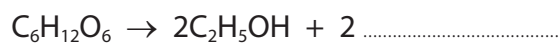
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7 (a) Ethanol, C₂H₅OH, can be produced by the fermentation of glucose, C₆H₁₂O₆

(i) Complete the equation for the fermentation of glucose. (1)



(ii) State why it is necessary for fermentation to be done in the absence of air. (1)

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(iii) Explain why the temperature should not be higher than 40°C. (2)

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(iv) When 4 mol of glucose is fermented, a mass of 55.2 g of ethanol is produced.

Show that the percentage yield of ethanol is 15%.

[M_r of C₂H₅OH = 46]

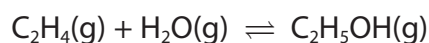
(2)



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(b) Ethanol can also be produced by the reaction between ethene and steam.

The equation for the reaction is



(i) This reaction is in dynamic equilibrium.

Give two features of a reaction in dynamic equilibrium.

(2)

1

2

(ii) When the equilibrium mixture is heated, the yield of ethanol decreases.

Explain whether the forward reaction is exothermic or endothermic.

(2)

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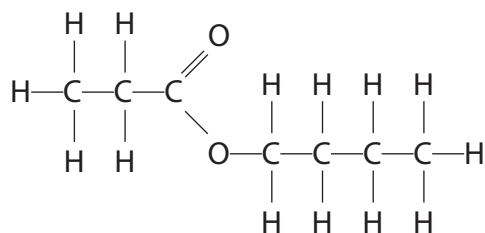
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(c) Carboxylic acids react with alcohols to form esters.

The displayed formula of an ester is



(i) Carboxylic acid A and alcohol B react to produce this ester.

Give the displayed formula of carboxylic acid A and of alcohol B.

(2)

Carboxylic acid A	Alcohol B

(ii) Indicators can be used to test for carboxylic acids.

Describe a different chemical test for a carboxylic acid.

(2)

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(Total for Question 7 = 14 marks)

TOTAL FOR PAPER = 70 MARKS



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