



Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE
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CO-ORDINATED SCIENCES

0654/43

Paper 4 Theory (Extended)

May/June 2019

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

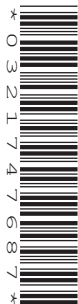
You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 32.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **31** printed pages and **1** blank page.



1 (a) Fig. 1.1 is a graph showing the effect of pH on an enzyme's activity at 20 °C.

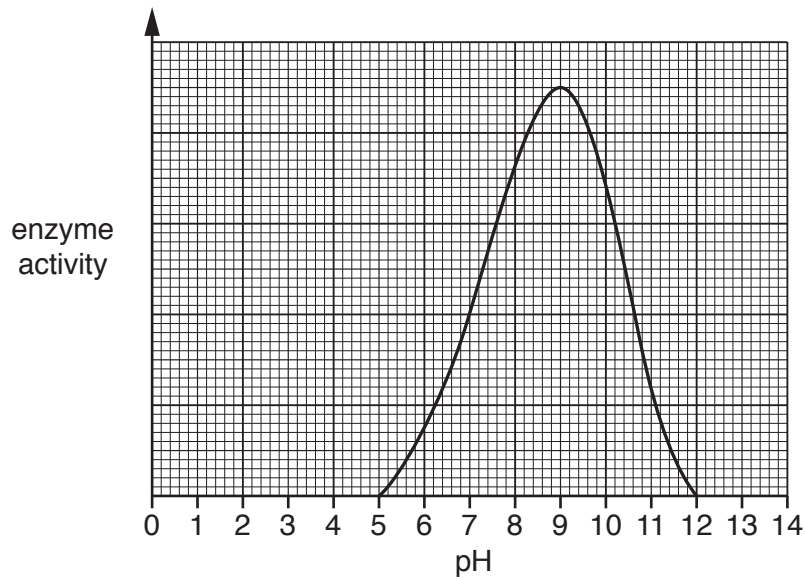


Fig. 1.1

(i) State the optimum pH of this enzyme.

..... [1]

(ii) Explain why this enzyme is inactive at pH 12.

.....

 [3]

(b) The investigation was repeated at a temperature of 30 °C.

There was an increase in enzyme activity recorded across the pH range.

Explain why there is an **increase** in enzyme activity at 30 °C.

.....

 [3]

(c) Enzymes are proteins.

(i) List the chemical elements that make up proteins.

..... [1]

(ii) State the test for the protein and the positive result.

test

positive result

[2]

[Total: 10]

2 Fig. 2.1 shows industrial processes carried out to make some useful materials from petroleum.

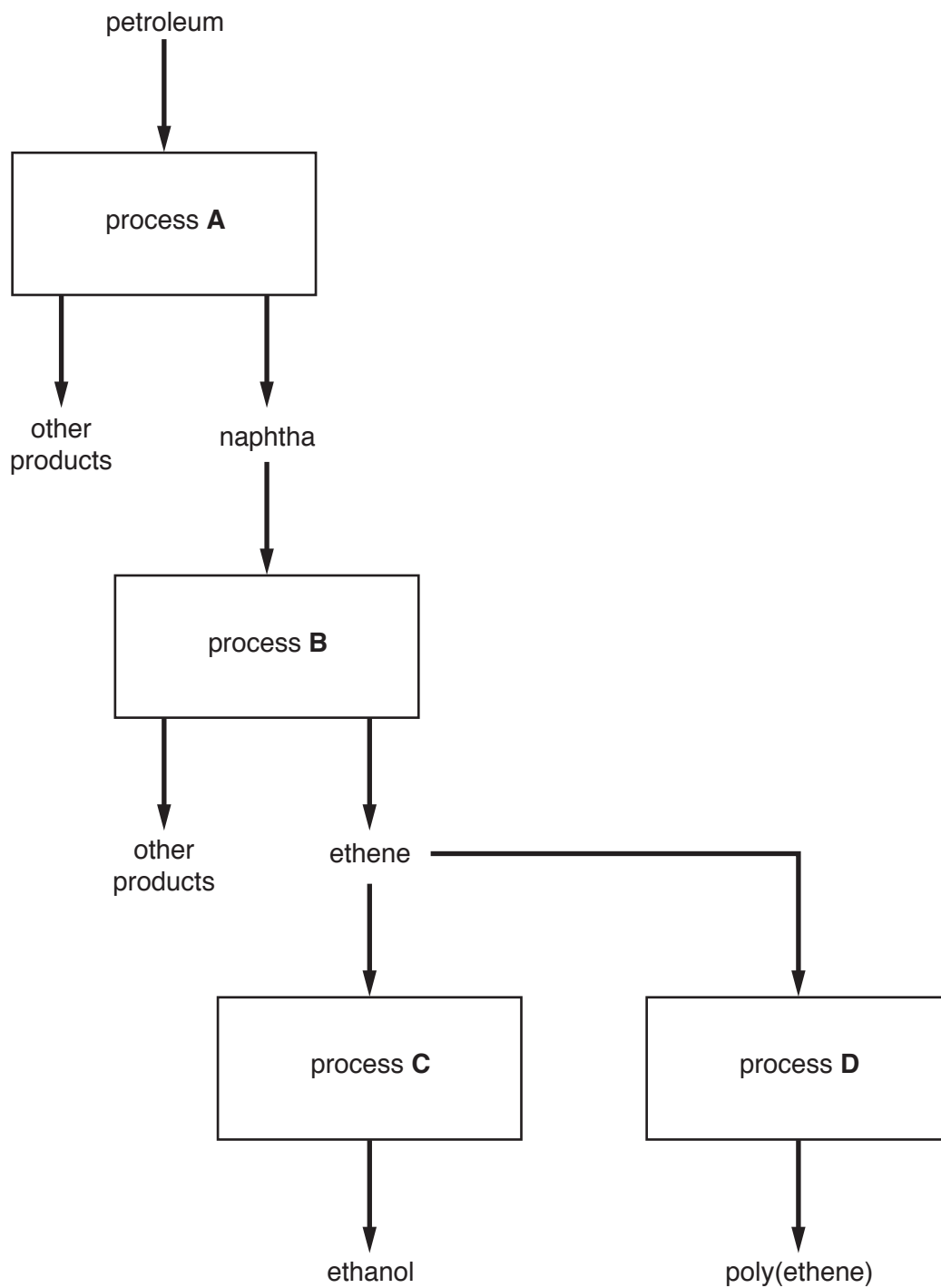


Fig. 2.1

(a) Use words and phrases from the list below to name the processes **A** to **D** in Fig. 2.1.

Each word or phrase may be used once, more than once or not at all.

Process **C** has been named for you.

addition polymerisation

catalytic addition

condensation polymerisation

cracking

dehydration

electrolysis

fractional distillation

oxidation

reduction

process **A**

process **B**

process **C** catalytic addition

process **D**

[3]

(b) In process **A** petroleum is separated into mixtures of hydrocarbons, such as naphtha.

State the physical property of naphtha that enables it to be separated from the other hydrocarbon mixtures in process **A**.

..... [1]

(c) In process **B**, larger molecules are changed into smaller molecules.

The energy level diagram for this reaction is shown in Fig. 2.2.

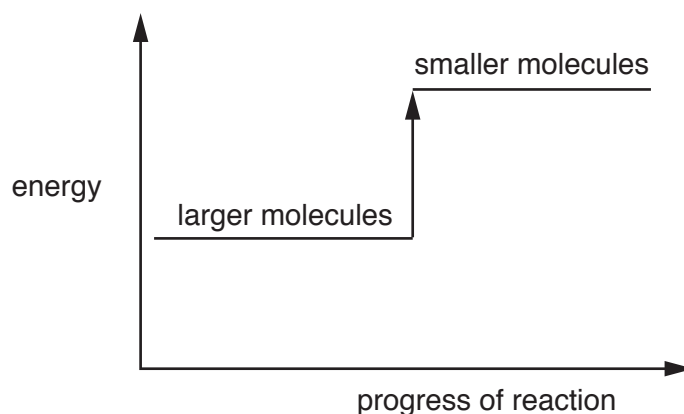


Fig 2.2

State the type of chemical reaction that causes the type of energy change shown in Fig. 2.2.

Explain your answer in terms of bond breaking and bond making.

type of reaction

explanation

.....

..... [3]

- (d) In process **C** ethene reacts with steam to produce ethanol, C_2H_5OH . A catalyst is used to increase the rate of reaction.

State **two** other conditions necessary for this reaction.

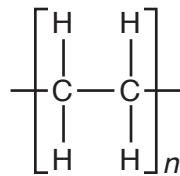
1

2

[2]

- (e) (i) In process **D** poly(ethene) is formed.

The structure of poly(ethene) is shown.



(n is a large number)

Describe the formation of poly(ethene) using the terms *monomer* and *polymer*.

.....

 [2]

- (ii) Ethene is reactive and reacts with bromine.

Poly(ethene) is less reactive and does not react with bromine.

Explain this difference.

.....
 [1]

[Total: 12]

- 3 (a) Fig. 3.1 shows the forces acting on an aircraft.

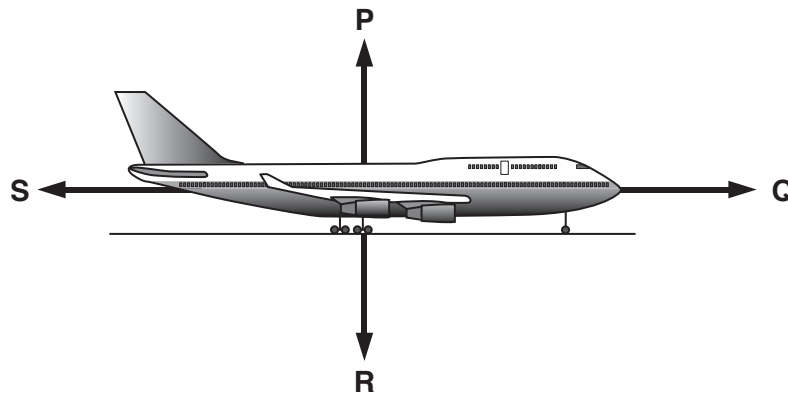


Fig. 3.1

Four forces **P**, **Q**, **R** and **S** are shown.

- (i) Compare the sizes of forces **Q** and **S** when the aircraft is accelerating.

.....
 [1]

- (ii) State which force is the weight of the aircraft.

..... [1]

- (iii) Complete the sentence below to describe the relationship between the mass and the weight of an object.

Weight is the effect of a field on a mass. [1]

(b) Fig. 3.2 is the speed-time graph for an aircraft during take-off.

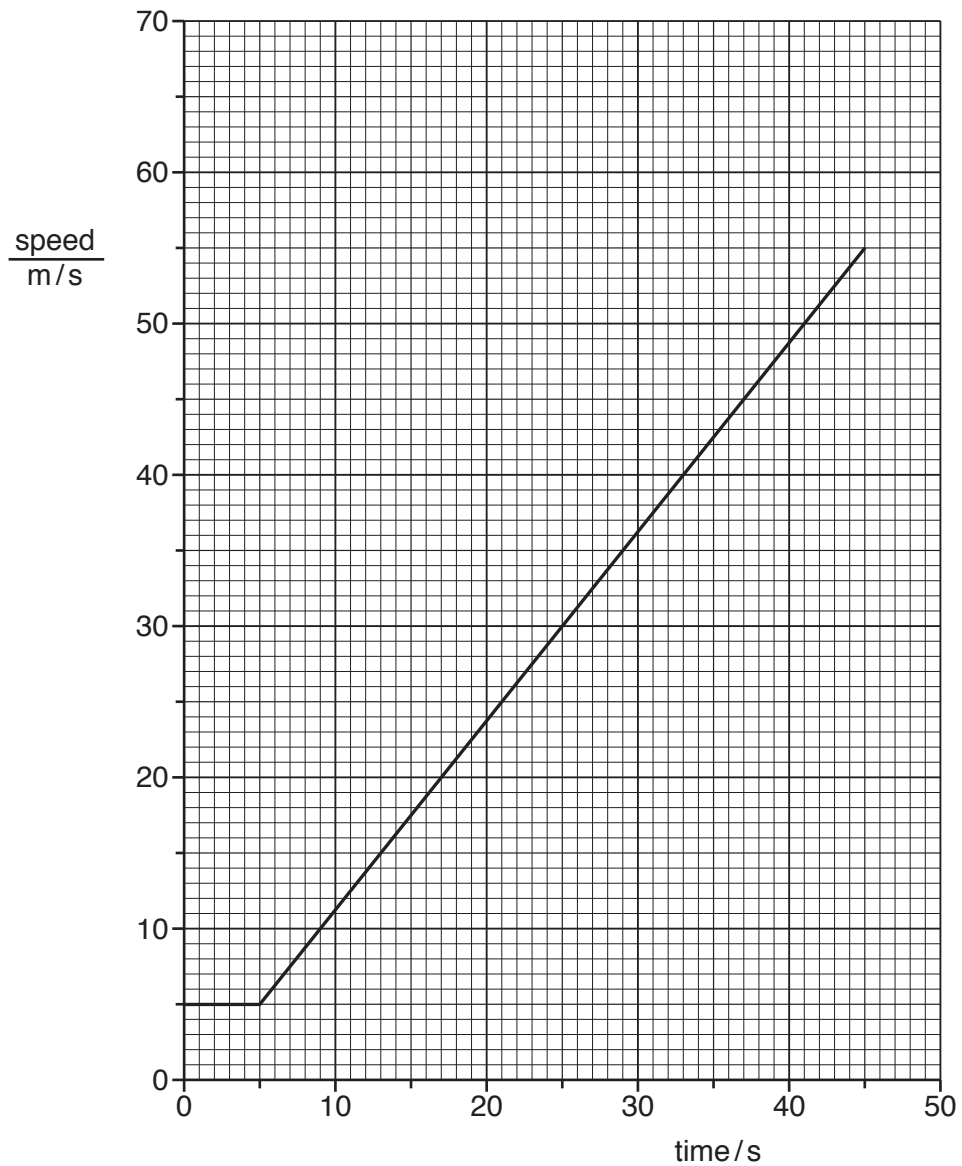


Fig. 3.2

Calculate the acceleration between 5 s and 45 s.

Show your working. State the units of your answer.

acceleration = units [3]

(c) State the **two** types of energy gained as the aircraft continues to accelerate and gain height after take-off.

- 1 energy
 - 2 energy
- [1]

(d) The aircraft engines are noisy. Sound waves from the engines pass through the air as a series of compressions and rarefactions.

(i) State what is meant by a *compression*.

.....
..... [1]

(ii) Describe the wavelength of a sound wave in terms of compressions.

.....
..... [1]

[Total: 9]

- 4 (a) Fig. 4.1 is a diagram of a food web.

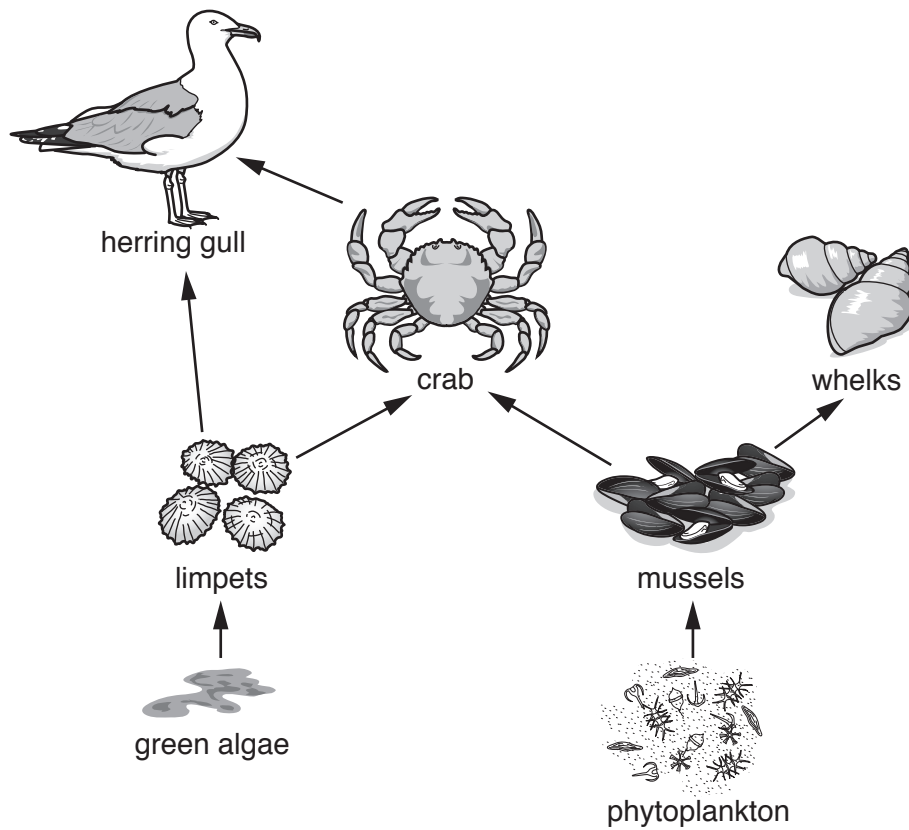


Fig. 4.1

Use the food web in Fig. 4.1 to answer these questions.

- (i) State the number of trophic levels in this food web.

..... [1]

- (ii) Name **one** organism that occupies the **first** trophic level.

..... [1]

- (iii) Construct a food chain that includes one **tertiary** consumer.

..... [2]

(b) A disease causes a decrease in the population of mussels.

Explain the effect of a decrease in **mussel** population on the **limpet** population.

.....
.....
.....
..... [2]

(c) Organisms in the food web respire.

Complete the sentence to define the term *respiration*.

Respiration is the reactions in cells that break
down molecules and release
..... for metabolism. [2]

[Total: 8]

- 5 (a) A teacher investigates the rate at which carbon dioxide is produced when dilute hydrochloric acid reacts with excess calcium carbonate powder.

She uses the apparatus shown in Fig. 5.1.

The temperature of the acid is 20 °C.

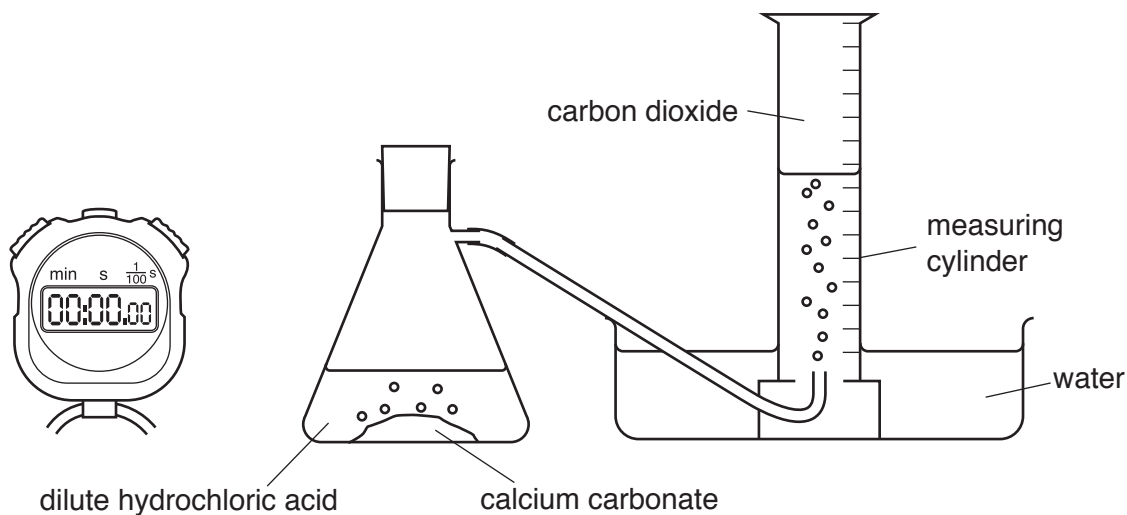


Fig. 5.1

She measures the volume of carbon dioxide collected in the measuring cylinder every minute for 10 minutes.

Fig. 5.2 shows a graph of her results.

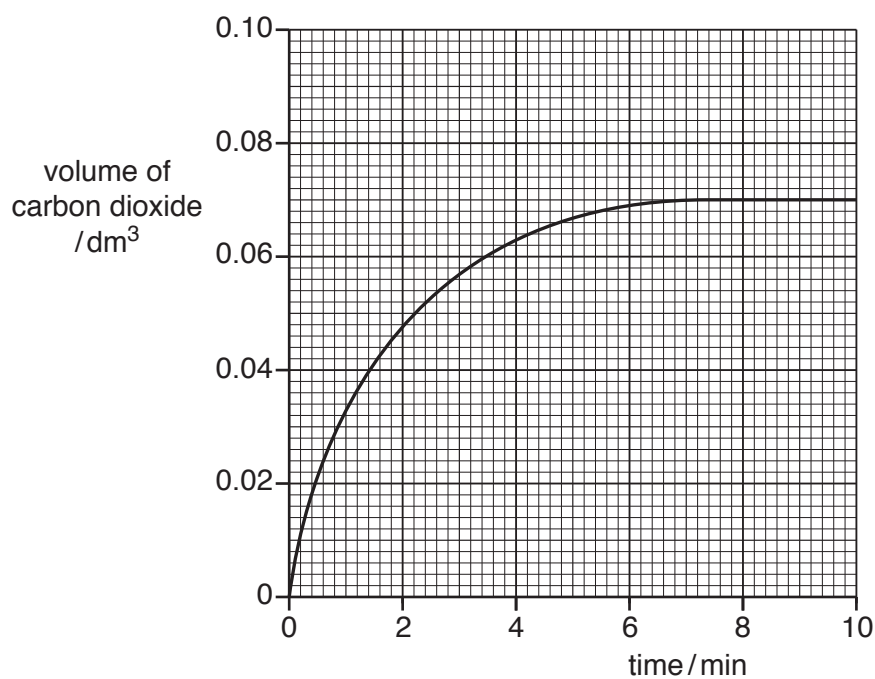


Fig. 5.2

- (i) Use ideas about colliding particles to explain the shape of the graph.

.....

 [3]

- (ii) The teacher repeats the experiment, adding dilute hydrochloric acid at 30 °C to excess calcium carbonate powder.

Sketch the graph she obtains on Fig. 5.2. [2]

- (b) The symbol equation for the reaction between calcium carbonate and dilute hydrochloric acid is shown.



- (i) State the volume of gas produced in 10 minutes when dilute hydrochloric acid at 20 °C is added to excess calcium carbonate powder.

..... dm³ [1]

- (ii) Use your answer to (b)(i) to calculate the volume of dilute hydrochloric acid added to the excess calcium carbonate.

Complete steps 1 to 3. Show your working.

The concentration of the dilute hydrochloric acid is 0.50 mol/dm³.

The volume of 1 mole of any gas is 24 dm³ at room temperature and pressure.

Step 1

Calculate the number of moles of carbon dioxide produced.

number of moles =

Step 2

Calculate the number of moles of HCl reacting.

number of moles =

Step 3

Calculate the volume of dilute acid added.

volume = dm³
 [3]

- (c) State the ratio of the number of molecules in 1 mole of carbon dioxide to the number of molecules in 1 mole of water.

..... [1]

[Total: 10]

- 6 (a) Fig 6.1 shows a penguin walking on the ice in Antarctica.



Fig. 6.1

The penguin has a weight of 25 N and its feet have a total area of 22 cm².

Calculate the pressure in N/m² exerted by the penguin on the ice when it is standing on both feet.

Show your working.

pressure = N/m² [3]

- (b) The penguin observes a fish swimming in a pool.

Fig. 6.2 shows a ray of light going from the fish to the penguin. The ray is refracted at the surface.

The angles of incidence and refraction are shown.

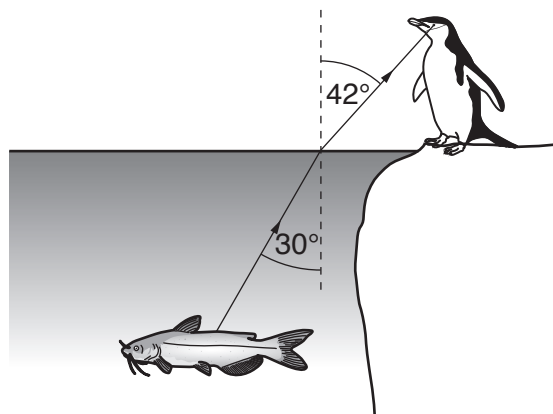


Fig. 6.2

Calculate the refractive index of water.

Show your working.

refractive index = [2]

- (c) The penguin jumps into the pool of water and produces water waves.

A 3-metre section of the pool is shown in Fig. 6.3.

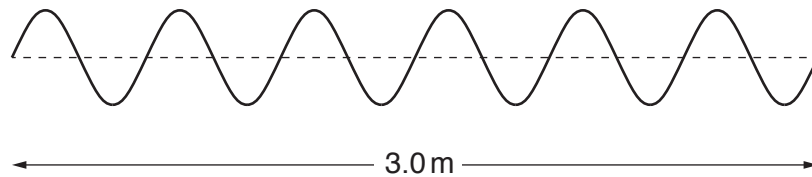


Fig. 6.3

- (i) Show that the wavelength of the waves is 0.5 m.

[1]

- (ii) The speed of the waves produced in the pool is 1.5 m/s.

Calculate the frequency of the waves.

Show your working.

frequency = Hz [2]

- (d) In the Antarctic, harmful ultraviolet radiation reaches the Earth's surface.

- (i) State **one** danger to living things of being exposed to large quantities of ionising radiation.

..... [1]

- (ii) α -particles and β -particles are both types of ionising radiation.

State **two** differences between an α -particle and a β -particle.

1

.....

2

.....

[2]

- (iii) An isotope of an unknown element decays by β -emission to produce an isotope of silicon, which has a nucleon number of 28.

Identify the unknown element and give its full nuclide notation.

A periodic table is shown on page 32.

..... [2]

[Total: 13]

7 A student investigates the need for chlorophyll in photosynthesis.

He uses a variegated leaf.

Fig. 7.1 shows a variegated leaf.

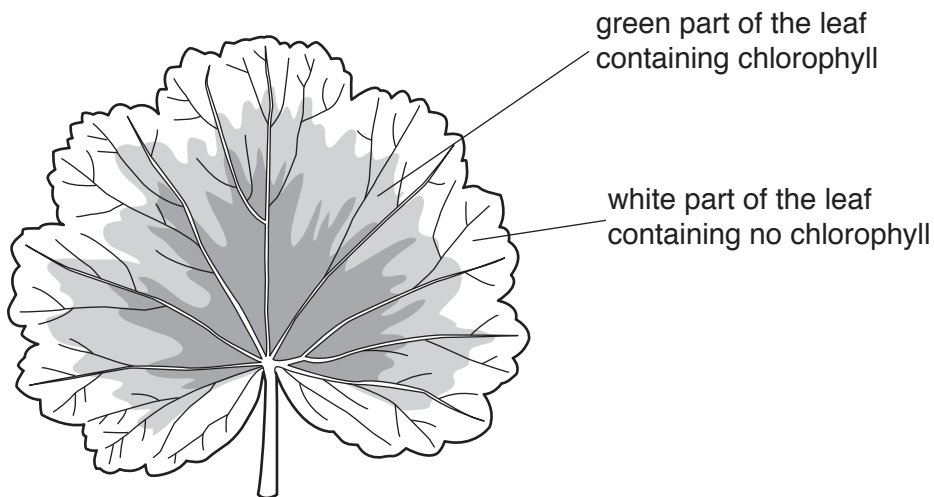


Fig. 7.1

The student prepares the leaf by boiling it in ethanol. He then tests the leaf for the presence of starch using iodine solution.

Table 7.1 shows his results.

Table 7.1

part of leaf	colour when tested with iodine solution
green part	blue-black
white part	orange-brown

(a) Explain the result for the green part of the leaf.

.....

.....

.....

.....

.....

..... [3]

(b) Name the mineral ion needed to make chlorophyll.

..... [1]

(c) Starch is one carbohydrate found in plants.

Describe how carbohydrates are transported around the plant.

.....

.....

.....

.....

..... [3]

(d) Water is one of the raw materials needed for photosynthesis.

State the chemical formula of **one other** raw material needed for photosynthesis.

..... [1]

(e) State the term used for the property of water molecules that enables them to be drawn up the xylem during transpiration.

..... [1]

[Total: 9]

8 Fig. 8.1 shows part of Group I of the Periodic Table.

3 Li lithium 7
11 Na sodium 23
19 K potassium 39
37 Rb rubidium 85

Fig. 8.1

(a) (i) State the electronic structure of a sodium atom.

..... [1]

(ii) Describe how the electronic structure of sodium is related to its group number.

.....
 [1]

(b) A teacher adds Universal Indicator solution to water in a large bowl.

She places a piece of sodium onto the surface of the water.

Fig. 8.2 shows the apparatus she uses.

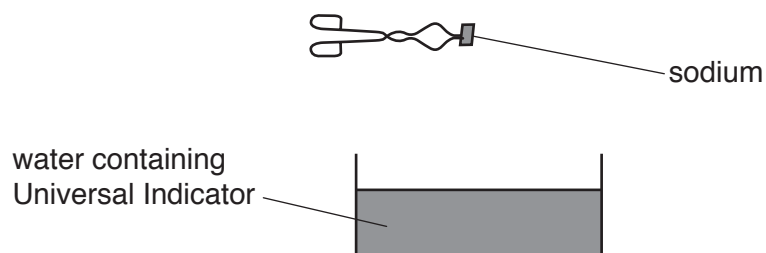


Fig. 8.2

Students notice that gas forms around the sodium and the indicator changes colour.

- (i) The teacher informs her students that hydrogen and sodium hydroxide are formed by the reaction.

State and explain the change in colour of the indicator.

change in colour

explanation

..... [2]

- (ii) Suggest **one** similarity and **one** difference between rubidium and sodium in their reaction with water containing Universal Indicator.

Explain your answers.

similarity

explanation

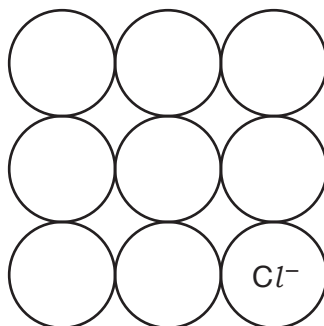
difference

explanation

[3]

- (c) Fig. 8.3 shows an incomplete diagram of part of the structure of a sodium chloride crystal.

Complete the diagram by showing the arrangement of sodium ions, Na^+ , and chloride ions, Cl^- .



(ions are not drawn to scale)

Fig. 8.3

[2]

[Total: 9]

9 Fig. 9.1 shows a potato being baked in the oven of an electric cooker.

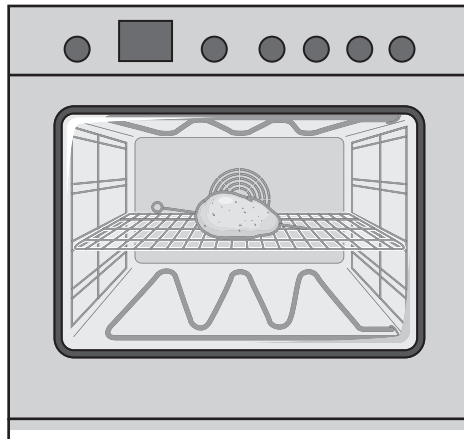


Fig. 9.1

(a) The potato has a steel skewer (a long metal pin) pushed through it.

When heated the metal skewer expands.

Explain in terms of the motion and arrangement of molecules why a solid expands less than a gas when heated.

.....

.....

.....

..... [2]

(b) A thermocouple is used to measure the temperature inside the oven.

Describe the structure of a thermocouple.

.....

..... [1]

(c) The cooker has one electrically heated hotplate. The hotplate uses a current of 2.0A when used with a mains voltage of 230 V.

(i) Calculate the resistance of the hotplate.

Show your working.

resistance = Ω [2]

(ii) Calculate the energy supplied to the hotplate in 1200 seconds.

Show your working.

energy = J [2]

(iii) Some water is heated in a saucepan and turns to steam.

Describe the differences between water and steam in terms of the forces and distances between the molecules and the motion of the molecules.

.....
.....
.....
..... [3]

[Total: 10]

10 (a) Fig. 10.1 shows the circulatory system of a fish and a human.

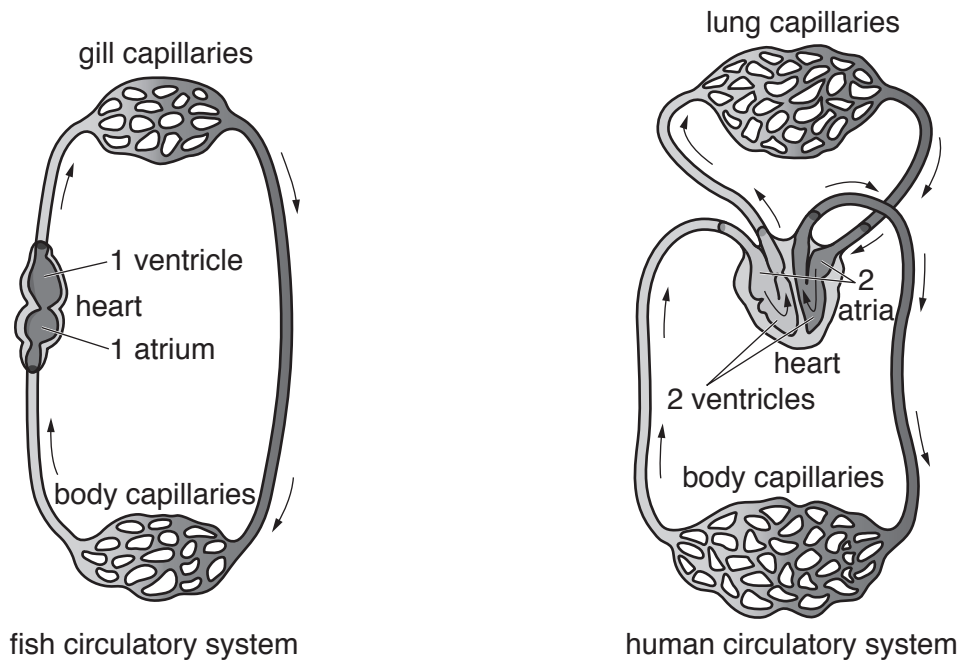


Fig. 10.1

(i) Use Fig. 10.1 to describe **three** ways the circulatory system of a human is different from the circulatory system of a fish.

- 1
 -
 - 2
 -
 - 3
 -
- [3]

(ii) State the name of the structure in the human heart that separates the left ventricle from the right ventricle.

.....[1]

(b) Gills are the gas exchange surface in fish.

Suggest **two** features that gills have that allow efficient gas exchange.

- 1
 - 2
- [2]

(c) The human circulatory system contains arterioles.

Arterioles are used in the regulation of body temperature.

Describe the role of arterioles in **reducing** body temperature.

.....

.....

.....

.....

..... [3]

[Total: 9]

- 11 Fig. 11.1 shows a blast furnace used to extract iron from iron oxide.

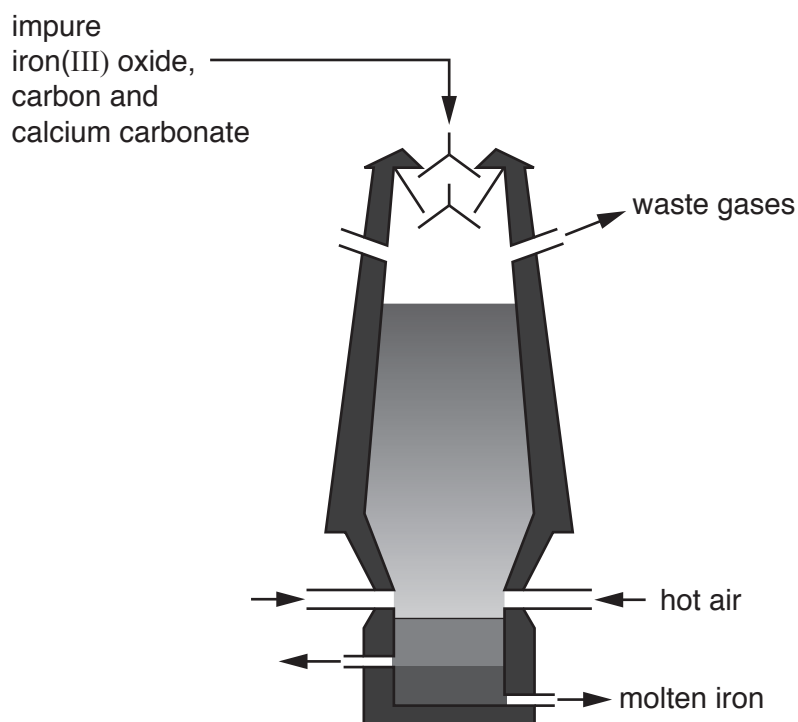


Fig. 11.1

- (a) State the substance that reacts with oxygen in the blast furnace.

..... [1]

- (b) (i) Identify the reducing agent that is formed in the blast furnace.

..... [1]

- (ii) Iron(III) oxide consists of iron ions, Fe^{3+} , and oxide ions, O^{2-} .

Use ideas about atoms, ions and electron transfer to explain how iron (III) oxide is reduced to iron.

.....

 [2]

- (c) Complete the sentences, using words from the list below, to describe how acidic impurities are removed in the blast furnace.

Each word or phrase may be used once, more than once or not at all.

air **calcium carbonate** **calcium oxide** **carbon**
carbon dioxide **iron** **silicon dioxide** **slag**

Calcium carbonate decomposes to and
 at the high temperature in the blast furnace.

Acidic impurities such as react with
 to form molten [3]

- (d) (i) Explain why a blast furnace cannot be used to extract aluminium from aluminium oxide.

 [1]

- (ii) Explain why aluminium appears to be resistant to corrosion.

 [1]

[Total: 9]

12 (a) Fig. 12.1 shows a gardener using a leaf-blower.



Fig. 12.1

Fig. 12.2 shows the energy input and outputs for the leaf-blower.

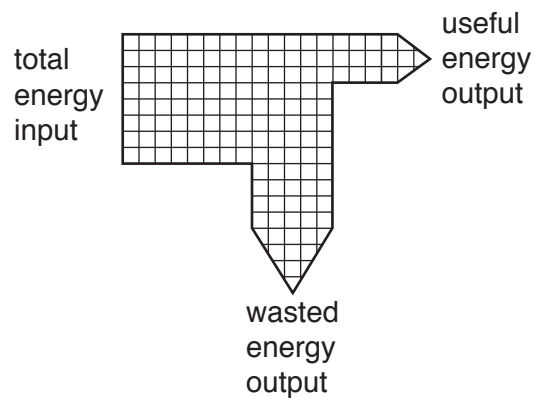


Fig. 12.2

Calculate the efficiency of the leaf-blower as a percentage.

Show your working.

efficiency = % [2]

(b) When used the leaf-blower takes a current of 3.0A.

Calculate the charge that flows through the leaf-blower when it is used for 180seconds.

Show your working.

charge = C [1]

(c) The leaf-blower contains a small electric motor powered by a battery.

Fig. 12.3 shows a simple electric motor powered by a battery.

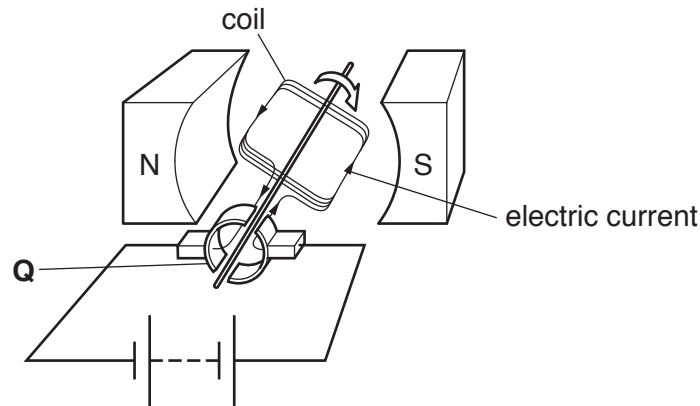


Fig. 12.3

(i) State the name of the component labelled **Q** on Fig. 12.3.

name of component **Q** [1]

(ii) Draw an arrow on Fig. 12.3 to show the direction of the magnetic field. [1]

(iii) Explain why the coil moves when an electric current passes through it.

.....

 [3]

[Total: 8]

- 13** A student investigates the effect of temperature on the movement of red dye through water. She adds one drop of red dye to the centre of the water in a Petri dish. She measures the time taken for the dye to move to the edge of the Petri dish. She repeats this with water at different temperatures.

Fig. 13.1 shows the apparatus used.

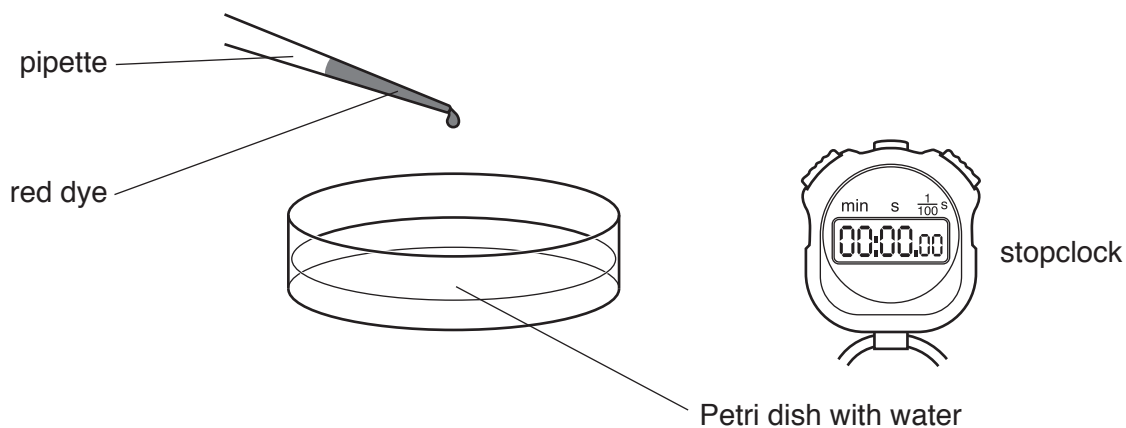


Fig. 13.1

Table 13.1 shows her results.

Table 13.1

temperature / °C	time taken for dye to move to the edge / s
5	321
40	98
80	55

- (a)** Use the results in Table 13.1 to describe the relationship between temperature and the time taken for the dye to move to the edge.

.....
 [1]

- (b)** Explain, in terms of particles, the movement of the red dye through the water.

.....

 [3]

[Total: 4]

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The Periodic Table of Elements

		Group							
I	II	III	IV	V	VI	VII	VIII		
3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20	
11 Na sodium 23	12 Mg magnesium 24	Key atomic number atomic symbol name relative atomic mass		13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —
			111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —
			118 Og oganesson —	119 Uue unbinilium —	120 Uuo unbinilium —	121 Uuq unbinilium —	122 Uub unbinilium —	123 Uut unbinilium —	124 Uuq unbinilium —
			125 Uup unbinilium —	126 Uuq unbinilium —	127 Uub unbinilium —	128 Uut unbinilium —	129 Uuq unbinilium —	130 Uub unbinilium —	131 Uut unbinilium —
			132 Uuq unbinilium —	133 Uub unbinilium —	134 Uut unbinilium —	135 Uuq unbinilium —	136 Uub unbinilium —	137 Uut unbinilium —	138 Uuq unbinilium —
			139 Uuq unbinilium —	140 Uub unbinilium —	141 Uut unbinilium —	142 Uuq unbinilium —	143 Uub unbinilium —	144 Uut unbinilium —	145 Uuq unbinilium —
			146 Uub unbinilium —	147 Uut unbinilium —	148 Uuq unbinilium —	149 Uub unbinilium —	150 Uut unbinilium —	151 Uuq unbinilium —	152 Uub unbinilium —
			153 Uut unbinilium —	154 Uuq unbinilium —	155 Uub unbinilium —	156 Uut unbinilium —	157 Uuq unbinilium —	158 Uub unbinilium —	159 Uut unbinilium —
			160 Uuq unbinilium —	161 Uub unbinilium —	162 Uut unbinilium —	163 Uuq unbinilium —	164 Uub unbinilium —	165 Uut unbinilium —	166 Uuq unbinilium —
			167 Uub unbinilium —	168 Uut unbinilium —	169 Uuq unbinilium —	170 Uub unbinilium —	171 Uut unbinilium —	172 Uuq unbinilium —	173 Uub unbinilium —
			174 Uut unbinilium —	175 Uuq unbinilium —	176 Uub unbinilium —	177 Uut unbinilium —	178 Uuq unbinilium —	179 Uub unbinilium —	180 Uut unbinilium —
			181 Uuq unbinilium —	182 Uub unbinilium —	183 Uut unbinilium —	184 Uuq unbinilium —	185 Uub unbinilium —	186 Uut unbinilium —	187 Uuq unbinilium —
			188 Uub unbinilium —	189 Uut unbinilium —	190 Uuq unbinilium —	191 Uub unbinilium —	192 Uut unbinilium —	193 Uuq unbinilium —	194 Uub unbinilium —
			195 Uut unbinilium —	196 Uuq unbinilium —	197 Uub unbinilium —	198 Uut unbinilium —	199 Uuq unbinilium —	200 Uub unbinilium —	201 Uut unbinilium —
			202 Uuq unbinilium —	203 Uub unbinilium —	204 Uut unbinilium —	205 Uuq unbinilium —	206 Uub unbinilium —	207 Uut unbinilium —	208 Uuq unbinilium —
			209 Uub unbinilium —	210 Uut unbinilium —	211 Uuq unbinilium —	212 Uub unbinilium —	213 Uut unbinilium —	214 Uuq unbinilium —	215 Uub unbinilium —
			216 Uut unbinilium —	217 Uuq unbinilium —	218 Uub unbinilium —	219 Uut unbinilium —	220 Uuq unbinilium —	221 Uub unbinilium —	222 Uut unbinilium —
			223 Uuq unbinilium —	224 Uub unbinilium —	225 Uut unbinilium —	226 Uuq unbinilium —	227 Uub unbinilium —	228 Uut unbinilium —	229 Uuq unbinilium —
			230 Uub unbinilium —	231 Uut unbinilium —	232 Uuq unbinilium —	233 Uub unbinilium —	234 Uut unbinilium —	235 Uuq unbinilium —	236 Uub unbinilium —
			237 Uut unbinilium —	238 Uuq unbinilium —	239 Uub unbinilium —	240 Uut unbinilium —	241 Uuq unbinilium —	242 Uub unbinilium —	243 Uut unbinilium —
			244 Uuq unbinilium —	245 Uub unbinilium —	246 Uut unbinilium —	247 Uuq unbinilium —	248 Uub unbinilium —	249 Uut unbinilium —	250 Uuq unbinilium —
			251 Uub unbinilium —	252 Uut unbinilium —	253 Uuq unbinilium —	254 Uub unbinilium —	255 Uut unbinilium —	256 Uuq unbinilium —	257 Uub unbinilium —
			258 Uut unbinilium —	259 Uuq unbinilium —	260 Uub unbinilium —	261 Uut unbinilium —	262 Uuq unbinilium —	263 Uub unbinilium —	264 Uut unbinilium —
			265 Uuq unbinilium —	266 Uub unbinilium —	267 Uut unbinilium —	268 Uuq unbinilium —	269 Uub unbinilium —	270 Uut unbinilium —	271 Uuq unbinilium —
			272 Uub unbinilium —	273 Uut unbinilium —	274 Uuq unbinilium —	275 Uub unbinilium —	276 Uut unbinilium —	277 Uuq unbinilium —	278 Uub unbinilium —
			279 Uut unbinilium —	280 Uuq unbinilium —	281 Uub unbinilium —	282 Uut unbinilium —	283 Uuq unbinilium —	284 Uub unbinilium —	285 Uut unbinilium —
			286 Uuq unbinilium —	287 Uub unbinilium —	288 Uut unbinilium —	289 Uuq unbinilium —	290 Uub unbinilium —	291 Uut unbinilium —	292 Uuq unbinilium —
			293 Uub unbinilium —	294 Uut unbinilium —	295 Uuq unbinilium —	296 Uub unbinilium —	297 Uut unbinilium —	298 Uuq unbinilium —	299 Uub unbinilium —
			300 Uut unbinilium —	301 Uuq unbinilium —	302 Uub unbinilium —	303 Uut unbinilium —	304 Uuq unbinilium —	305 Uub unbinilium —	306 Uut unbinilium —
			307 Uuq unbinilium —	308 Uub unbinilium —	309 Uut unbinilium —	310 Uuq unbinilium —	311 Uub unbinilium —	312 Uut unbinilium —	313 Uuq unbinilium —
			314 Uub unbinilium —	315 Uut unbinilium —	316 Uuq unbinilium —	317 Uub unbinilium —	318 Uut unbinilium —	319 Uuq unbinilium —	320 Uub unbinilium —
			321 Uut unbinilium —	322 Uuq unbinilium —	323 Uub unbinilium —	324 Uut unbinilium —	325 Uuq unbinilium —	326 Uub unbinilium —	327 Uut unbinilium —
			328 Uuq unbinilium —	329 Uub unbinilium —	330 Uut unbinilium —	331 Uuq unbinilium —	332 Uub unbinilium —	333 Uut unbinilium —	334 Uuq unbinilium —
			335 Uub unbinilium —	336 Uut unbinilium —	337 Uuq unbinilium —	338 Uub unbinilium —	339 Uut unbinilium —	340 Uuq unbinilium —	341 Uub unbinilium —
			342 Uut unbinilium —	343 Uuq unbinilium —	344 Uub unbinilium —	345 Uut unbinilium —	346 Uuq unbinilium —	347 Uub unbinilium —	348 Uut unbinilium —
			349 Uuq unbinilium —	350 Uub unbinilium —	351 Uut unbinilium —	352 Uuq unbinilium —	353 Uub unbinilium —	354 Uut unbinilium —	355 Uuq unbinilium —
			356 Uub unbinilium —	357 Uut unbinilium —	358 Uuq unbinilium —	359 Uub unbinilium —	360 Uut unbinilium —	361 Uuq unbinilium —	362 Uub unbinilium —
			363 Uut unbinilium —	364 Uuq unbinilium —	365 Uub unbinilium —	366 Uut unbinilium —	367 Uuq unbinilium —	368 Uub unbinilium —	369 Uut unbinilium —
			370 Uuq unbinilium —	371 Uub unbinilium —	372 Uut unbinilium —	373 Uuq unbinilium —	374 Uub unbinilium —	375 Uut unbinilium —	376 Uuq unbinilium —
			377 Uub unbinilium —	378 Uut unbinilium —	379 Uuq unbinilium —	380 Uub unbinilium —	381 Uut unbinilium —	382 Uuq unbinilium —	383 Uub unbinilium —
			384 Uut unbinilium —	385 Uuq unbinilium —	386 Uub unbinilium —	387 Uut unbinilium —	388 Uuq unbinilium —	389 Uub unbinilium —	390 Uut unbinilium —
			391 Uuq unbinilium —	392 Uub unbinilium —	393 Uut unbinilium —	394 Uuq unbinilium —	395 Uub unbinilium —	396 Uut unbinilium —	397 Uuq unbinilium —
			398 Uub unbinilium —	399 Uut unbinilium —	400 Uuq unbinilium —	401 Uub unbinilium —	402 Uut unbinilium —	403 Uuq unbinilium —	404 Uub unbinilium —
			405 Uut unbinilium —	406 Uuq unbinilium —	407 Uub unbinilium —	408 Uut unbinilium —	409 Uuq unbinilium —	410 Uub unbinilium —	411 Uut unbinilium —
			412 Uuq unbinilium —	413 Uub unbinilium —	414 Uut unbinilium —	415 Uuq unbinilium —	416 Uub unbinilium —	417 Uut unbinilium —	418 Uuq unbinilium —
			419 Uub unbinilium —	420 Uut unbinilium —	421 Uuq unbinilium —	422 Uub unbinilium —	423 Uut unbinilium —	424 Uuq unbinilium —	425 Uub unbinilium —
			426 Uut unbinilium —	427 Uuq unbinilium —	428 Uub unbinilium —	429 Uut unbinilium —	430 Uuq unbinilium —	431 Uub unbinilium —	432 Uut unbinilium —
			433 Uuq unbinilium —	434 Uub unbinilium —	435 Uut unbinilium —	436 Uuq unbinilium —	437 Uub unbinilium —	438 Uut unbinilium —	439 Uuq unbinilium —
			440 Uub unbinilium —	441 Uut unbinilium —	442 Uuq unbinilium —	443 Uub unbinilium —	444 Uut unbinilium —	445 Uuq unbinilium —	446 Uub unbinilium —
			447 Uut unbinilium —	448 Uuq unbinilium —	449 Uub unbinilium —	450 Uut unbinilium —	451 Uuq unbinilium —	452 Uub unbinilium —	453 Uut unbinilium —
			454 Uuq unbinilium —	455 Uub unbinilium —	456 Uut unbinilium —	457 Uuq unbinilium —	458 Uub unbinilium —	459 Uut unbinilium —	460 Uuq unbinilium —
			461 Uub unbinilium —	462 Uut unbinilium —	463 Uuq unbinilium —	464 Uub unbinilium —	465 Uut unbinilium —	466 Uuq unbinilium —	467 Uub unbinilium —
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			475 Uuq unbinilium —	476 Uub unbinilium —	477 Uut unbinilium —	478 Uuq unbinilium —	479 Uub unbinilium —	480 Uut unbinilium —	481 Uuq unbinilium —
			482 Uub unbinilium —	483 Uut unbinilium —	484 Uuq unbinilium —	485 Uub unbinilium —	486 Uut unbinilium —	487 Uuq unbinilium —	488 Uub unbinilium —
			489 Uut unbinilium —	490 Uuq unbinilium —	491 Uub unbinilium —	492 Uut unbinilium —	493 Uuq unbinilium —	494 Uub unbinilium —	495 Uut unbinilium —
			496 Uuq unbinilium —	497 Uub unbinilium —	498 Uut unbinilium —	499 Uuq unbinilium —	500 Uub unbinilium —	501 Uut unbinilium —	502 Uuq unbinilium —
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			517 Uuq unbinilium —	518 Uub unbinilium —	519 Uut unbinilium —	520 Uuq unbinilium —	521 Uub unbinilium —	522 Uut unbinilium —	523 Uuq unbinilium —
			524 Uub unbinilium —	525 Uut unbinilium —	526 Uuq unbinilium —	527 Uub unbinilium —	528 Uut unbinilium —	529 Uuq unbinilium —	530 Uub unbinilium —
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			538 Uuq unbinilium —	539 Uub unbinilium —	540				