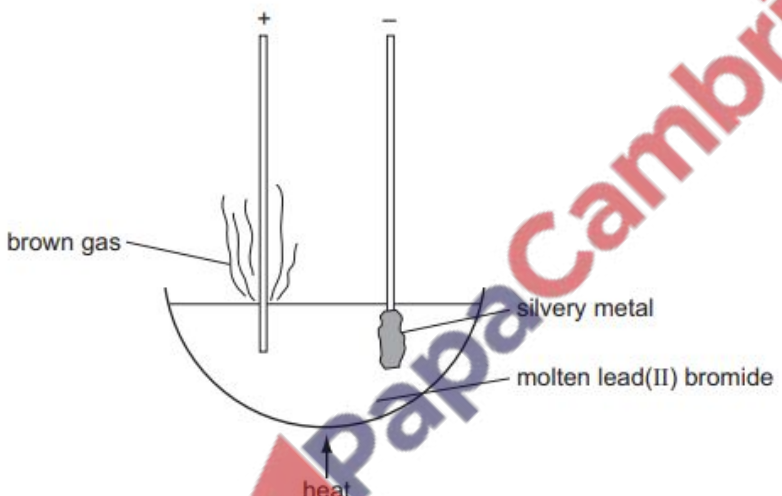
O LEVEL CHEMISTRY 5070
DIFFICULT QUESTIONS / PAPER 1
COMPILED BY OMAR ALI

MAY JUNE 2011

5: A student tested a solution by adding aqueous sodium hydroxide. A precipitate was not seen because the reagent was added too quickly. What could not have been present in the solution?

A Al 3+ B Ca2+ C NH4 + D Zn2+

13 The diagram shows the electrolysis of molten lead(II) bromide using inert electrodes.



What happens during this electrolysis?

A Atoms change to ions.

B Covalent bonds are broken.

C Ions change to atoms.

D New compounds are formed.

18 Which acid and base react together to produce an insoluble salt?

A hydrochloric acid and sodium hydroxide

B nitric acid and calcium oxide

C sulfuric acid and barium hydroxide

D sulfuric acid and zinc oxide

25 What happens when zinc foil is placed in an aqueous solution of copper(II) sulfate?
A Copper(II) ions are oxidised.
B There is no reaction.
C Zinc atoms are oxidised.
D Zinc sulfate is precipitated.

28 Scrap iron is often recycled. Which reason for recycling is not correct?
A It reduces the amount of pollution at the site of the ore extraction.
B It reduces the amount of waste taken to landfill sites.
C It reduces the need to collect the scrap iron.
D It saves natural resources.

36 Which bond is present in both nylon and Terylene?
A C – O B C = O C N – C D N – H

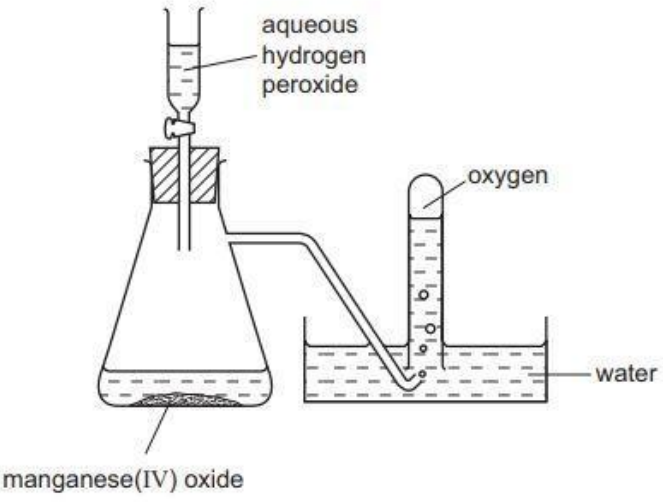
OCTOBER NOVEMBER 2011/11

1 In a titration between an acid (in the burette) and an alkali, you may need to re-use the same titration flask. Which is the best procedure for rinsing the flask?
A Rinse with distilled water and then with the alkali.
B Rinse with tap water and then with distilled water.
C Rinse with tap water and then with the acid.
D Rinse with the alkali.

7 A researcher notices that atoms of an element are releasing energy. Why are the atoms releasing energy?
A The atoms are absorbing light.
B The atoms are evaporating.
C The atoms are radioactive.
D The atoms react with argon in the air.

3 Oxygen was prepared from hydrogen peroxide, with manganese(IV) oxide as catalyst. The oxygen was collected as shown in the diagram.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$



The first few tubes of gas were rejected because the gas was contaminated by

A hydrogen.

B hydrogen peroxide.

C nitrogen.

D water vapour.

14 Which statement about the electrolysis of an aqueous solution of copper(II) sulfate with platinum electrodes is correct?

A Oxygen is given off at the positive electrode.
B The mass of the negative electrode remains constant.
C The mass of the positive electrode decreases.
D There is no change in the colour of the solution.

16 The following reversible reaction takes place in a closed vessel at constant temperature. P(g) + Q(g) + R(g) --------> S(g) + T(g) When the system has reached
< -------
equilibrium, more T is added. Which increases in concentration occur?

A P, Q, R and S B P and Q only C P, Q and R only D S only

28 Which gas cannot be removed from the exhaust gases of a petrol-powered car by its catalytic converter?

A carbon dioxide B carbon monoxide C hydrocarbons D nitrogen dioxide

30 Which statement shows that diamond and graphite are different forms of the element carbon?

A Both have giant molecular structures.
B Complete combustion of equal masses of each produces equal masses of carbon dioxide as the only product.
C Graphite conducts electricity, whereas diamond does not.
D Under suitable conditions, graphite can be converted into diamond.

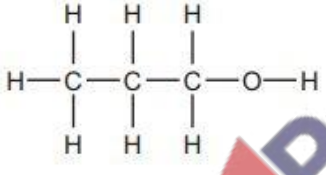
32 A sample of tap water gave a white precipitate with acidified silver nitrate. What does this show about the tap water?

A It contained chloride.
B It contained harmful microbes.
C It contained nitrates.
D It had not been filtered.

34 A hydride is a compound containing only two elements, one of which is hydrogen. Which element forms the most hydrides?

A carbon B chlorine C nitrogen D oxygen

35 The structural formulae of some organic compounds are shown below.



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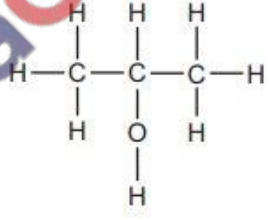

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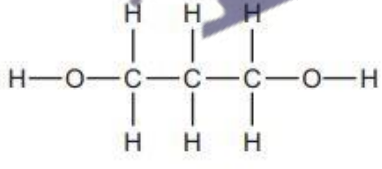

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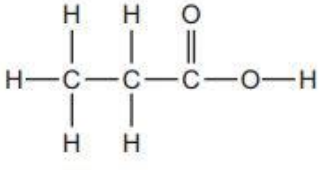


4

Which compounds are alcohols?

A 1, 2, 3 and 4 **B** 1 and 2 only **C** 1, 2 and 3 only **D** 4 only

39 Under certain conditions 1 mole of ethane reacts with 2 moles of chlorine in a substitution reaction. What is the formula of the organic product in this reaction?

A C_2H_5Cl **B** $C_2H_4Cl_2$ **C** $C_2H_2Cl_4$ **D** CH_2Cl_2

MAY JUNE 2012/11

4 The addition of dilute acid to a solution containing the anion Q and the subsequent use of limewater can be used to identify the anion Q. What is Q?

A a carbonate B a chloride C an iodide D a sulfate

15 Aqueous copper(II) sulfate is electrolysed using copper electrodes. Which equation represents the reaction taking place at the anode (positive electrode) in this electrolysis?

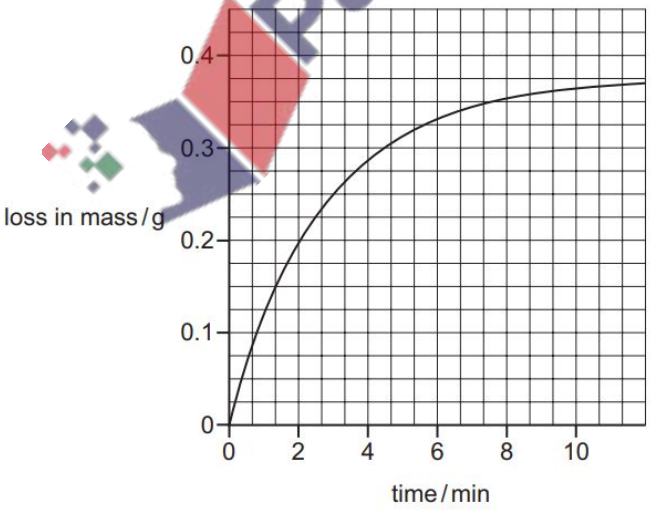
A $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$

B $SO_4^{2-}(aq) \rightarrow SO_2(g) + O_2(g) + 2e^-$

C $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

D $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

18 Copper(II) carbonate powder was heated. The loss in mass was plotted against time as shown on the graph.



During which time interval is the reaction fastest?

A 0 to 2 min **B** 2 to 4 min **C** 6 to 8 min **D** 8 to 10 min

31 Which gases are formed during the production of aluminium by the electrolysis of molten aluminium oxide?

A carbon dioxide, carbon monoxide, oxygen
B carbon dioxide, carbon monoxide, sulfur dioxide
C carbon dioxide, oxygen, sulfur dioxide
D carbon monoxide, oxygen, sulfur dioxide

33 In which parts of a motor car do the reactions, shown in the equations, take place?

	$N_2 + O_2 \rightarrow 2NO$	$2CO + 2NO \rightarrow 2CO_2 + N_2$
A	engine	engine
B	engine	exhaust
C	exhaust	engine
D	exhaust	exhaust

34 The diagrams show four monomers.

How many of these monomers would react with the molecule below to form a polymer?

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

35 For which molecules are the empirical and molecular formulae the same?

1. methanoic acid, HCO_2H
2. ethanoic acid, CH_3CO_2H
3. propanoic acid, $C_2H_5CO_2H$
4. butanoic acid, $C_3H_7CO_2H$

A 1, 2 and 3 only
B 1 and 3 only
C 2 and 3 only
D 2, 3 and 4 only

36 A compound Y is thought to be an organic acid. Which reaction shows that Y is an organic acid?

A It reacts with an alcohol to form an ester.

B It reacts with magnesium to form hydrogen.

C It reacts with sodium carbonate to form carbon dioxide.

D It turns litmus red.

37 A 10 cm^3 sample of a gaseous hydrocarbon is completely burnt in oxygen. The total volume of the products is 70 cm^3. All gas volumes are measured at room temperature and pressure.

Which equation represents the combustion of the hydrocarbon?

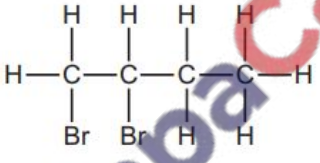
A $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

B $C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g)$

C $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$

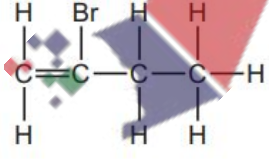
D $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$

40 Compound Q reacts with bromine to form the compound shown.



Which is compound Q?

A



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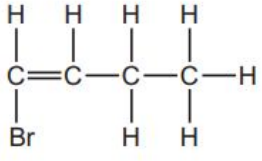

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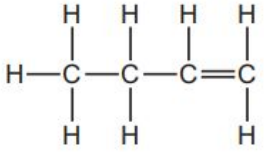

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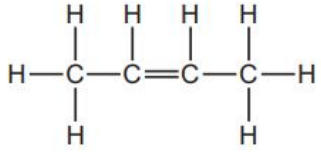


MAY JUNE 2012/12

5 Which reagent could be used to distinguish between dilute nitric acid and dilute hydrochloric acid?
A aqueous barium chloride
B aqueous silver nitrate
C aqueous sodium hydroxide
D copper(II) carbonate

7 Pentane, C5H12, has a higher boiling point than propane, C3H8. Which statement explains the difference in boiling point?
A Carbon-carbon single bonds are stronger than carbon-hydrogen bonds.
B Pentane has more covalent bonds to break.
C Pentane does not burn as easily as propane.
D The forces of attraction between pentane molecules are stronger than those between propane molecules

17 The oxide Q dissolves in water to form a colourless solution. This solution reacts with sodium carbonate to produce carbon dioxide. What is Q?
A copper(II) oxide
B sodium oxide
C sulfur dioxide
D zinc oxide

32 Aluminium is manufactured by the electrolysis of aluminium oxide.

Which substances are formed at the electrodes?

	positive electrode	negative electrode
A	aluminium	carbon dioxide
B	aluminium	oxygen
C	carbon dioxide	aluminium
D	oxygen	carbon dioxide

35 Which compound has more than two carbon atoms per molecule?

A ethanoic acid

B ethanol

C ethene

D ethyl ethanoate

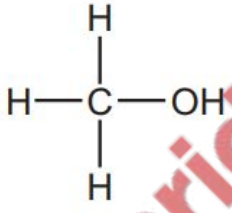
37 Which statement about methanol is correct?

A It can be oxidised to form methanoic acid.

B It is a constituent of alcoholic drinks.

C It is formed by fermentation.

D Its fully displayed structural formula is



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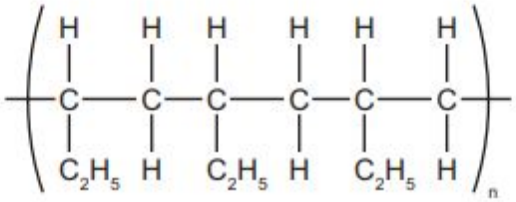
D $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$

40 The section of a polymer chain is shown.



Which molecule would produce this polymer and by which type of polymerisation?

	molecule	type of polymerisation
A	$CH_3–CH=CH–CH_3$	condensation
B	$CH_3–CH_2–CH=CH_2$	addition
C	$CH_3–CH_2–CH_2–CH=CH_2$	condensation
D	$CH_3–CH=CH–CH_3$	addition

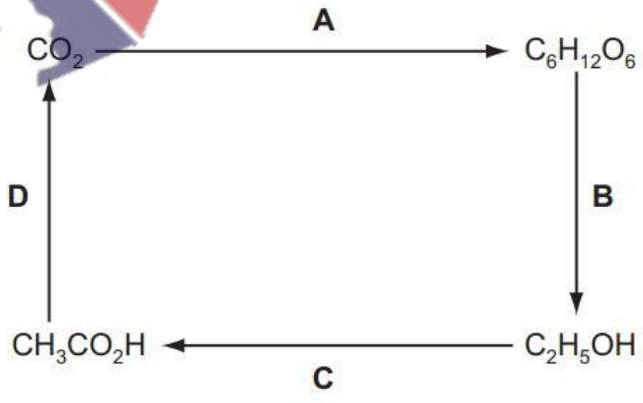
ON2012/11

1 It is suspected that a lollipop contains traces of a poisonous green dye (boiling point 73°C) as well as two harmless orange and red dyes (boiling points 69°C and 73°C respectively). What is the best method by which the green dye may be detected?

A filtration B fractional distillation C paper chromatography D recrystallisation

15 The diagram shows the steps by which carbon dioxide can be converted into organic products and finally returned to the atmosphere.

Which step is endothermic?



16 Which industrial reaction does not involve a catalyst?

A the cracking of hydrocarbons

B the extraction of iron from haematite in a blast furnace

C the production of ammonia from nitrogen and hydrogen

D the redox reaction involving the removal of combustion pollutants from car exhausts

24 A metal, X, has a low melting point, reacts with water, forms only one oxide and is extracted from its ore by electrolysis. What is the identity of X?

A aluminium B copper C iron D sodium

25 Metallic objects may be decorated by having very thin layers of gold applied to them.

Which properties of gold make it suitable for this use?

	it conducts electricity	it is malleable	it is unreactive
A	✗	✓	✓
B	✓	✗	✓
C	✓	✓	✗
D	✓	✓	✓

28 Which gas can be removed from the exhaust gases of a petrol-powered car by its catalytic converter?

A carbon monoxide B carbon dioxide C nitrogen D steam

31 Which contains the greatest mass of nitrogen?

A 0.5 moles $(NH_4)_2SO_4$

B 1 mole NH_4NO_3

C 1.5 moles $(NH_4)_3PO_4$

D 2 moles $CO(NH_2)_2$

33 Which statement about macromolecules is correct?

A Nylon and Terylene are both polyesters.
B Proteins and nylon have the same monomer units.
C Proteins have the same amide linkages as nylon.
D Terylene and fats are esters but with different linkages.

ON2012/12

10 Which substance has metallic bonding?

	conducts electricity		state of substance formed on reaction with oxygen
	when solid	when liquid	
A	✓	✓	solid
B	✓	✓	gas
C	✗	✓	no reaction
D	✗	✗	solid

14 Two of the reactions used in the manufacture of nitric acid, HNO_3, are shown.

$$2NO + O_2 \rightarrow 2NO_2$$

$$4NO_2 + 2H_2O + O_2 \rightarrow 4HNO_3$$

What is the maximum number of moles of nitric acid which could be formed from one mole of nitrogen monoxide, NO?

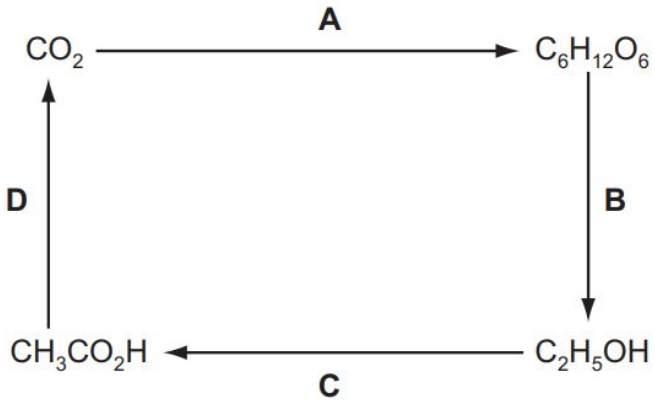
A 0.5 **B** 1.0 **C** 2.0 **D** 4.0

35 A factory manufactures poly(ethene). Which raw material will the factory need?

A bitumen B methane C methanol D naphtha

19 The diagram shows the steps by which carbon dioxide can be converted into organic products and finally returned to the atmosphere.

Which step is an example of combustion?



MAY/JUNE 2013/11

9 Which substance conducts an electric current but remains chemically unchanged?

A aluminium

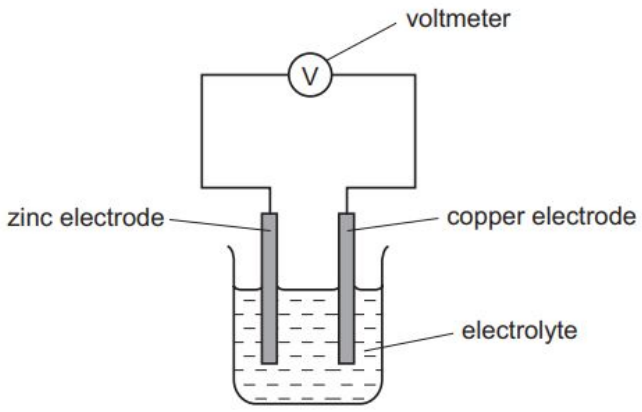
B aqueous sodium chloride

C molten lead(II) bromide

D pure ethanoic acid

HINT FOR THE NEXT QUESTION: More reactive metal is on the anode and less reactive metal is on the cathode.

15 A simple cell is shown below.



Which statement about the process occurring when the cell is in operation is correct?

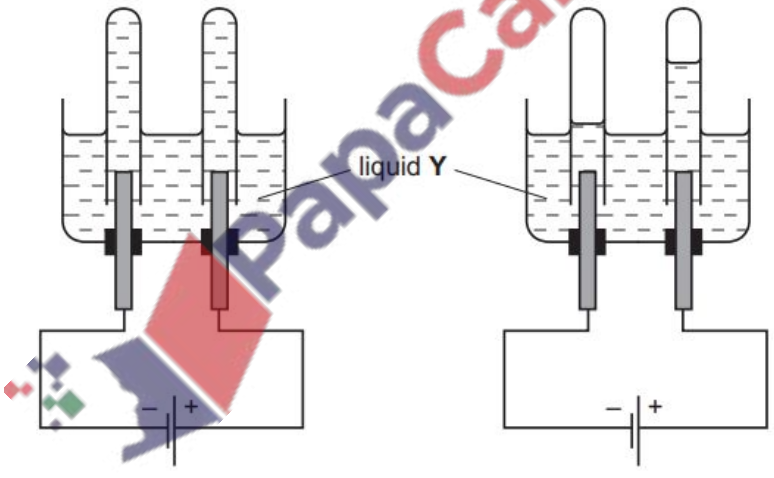
A Cu^{2+} ions are formed in solution.

B Electrons travel through the solution.

C The reaction $Zn \rightarrow Zn^{2+} + 2e^{-}$ occurs.

D Zinc increases in mass.

13 The diagrams show an electrolysis experiment using inert electrodes.



before electrolysis after electrolysis

Which could be liquid **Y**?

A aqueous copper(II) sulfate

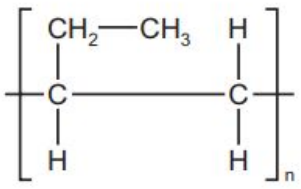
B concentrated aqueous sodium chloride

C dilute sulfuric acid

D ethanol

38 Which partial structure is correct for the product of polymerisation of butene, $CH_2=CHCH_2CH_3$?

A



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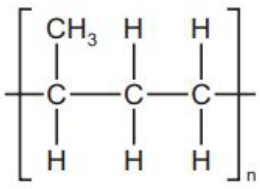

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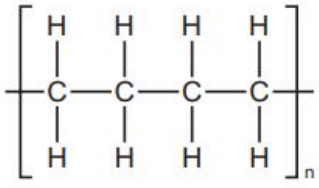

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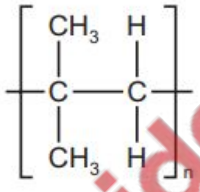


MAY/JUNE 2013/12

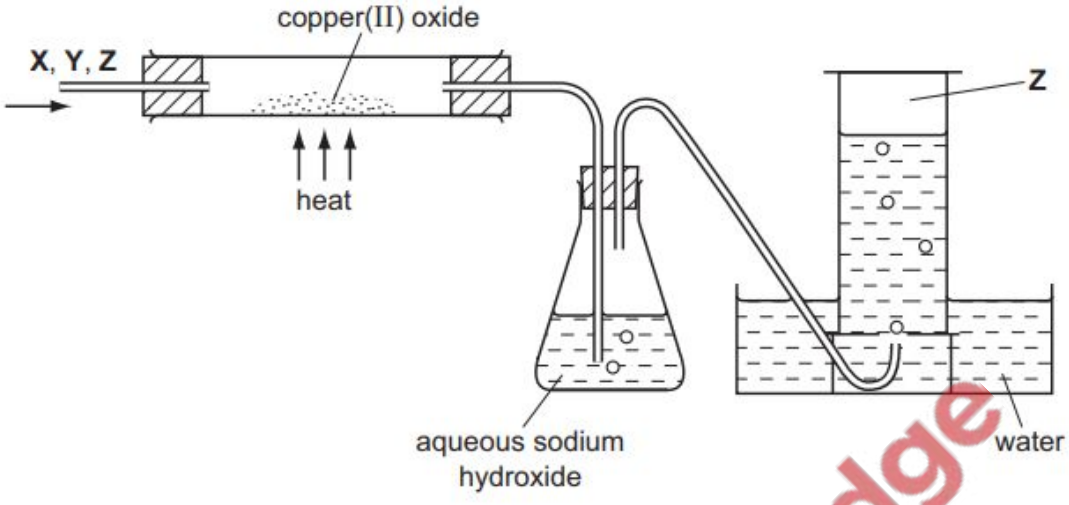
4 The structure of metals consists of positive ions in a 'sea of electrons'. Which statement correctly describes what happens to the particles in the metallic heating element of an electric kettle when the kettle is switched on?

A Electrons move in both directions in the element.
B Electrons move in one direction only in the element.
C Electrons move in one direction and positive ions move in the opposite direction in the element.
D Positive ions move in one direction only in the element.

23 Which property is common to calcium, potassium and sodium?

A Their atoms all have more neutrons than protons.
B Their ions all have eight electrons in their outer shell.
C They all sink when added to water.
D They are all deposited at the positive electrode when their molten chloride is electrolysed.

28 Gas **Z** is to be separated from a mixture of gases **X**, **Y** and **Z** by the apparatus shown in the diagram.



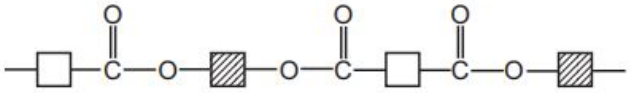
For which mixture will this system work successfully?

	X	Y	Z
A	hydrogen	carbon dioxide	nitrogen
B	oxygen	hydrogen	carbon monoxide
C	nitrogen	oxygen	hydrogen
D	carbon dioxide	nitrogen	oxygen

36 Which polymer contains only three elements?

A protein B poly(ethene) C poly(propene) D starch

38 The diagram shows the partial structure of *Terylene*.



From which pair of compounds is it made?

A 

B 

C 

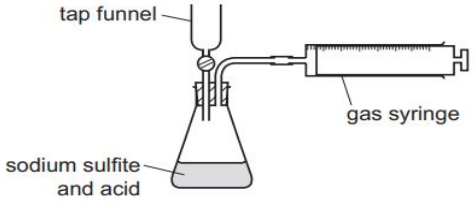
D 

ON 2013/11

3 A student wanted to follow how the rate of the reaction of sodium sulfite with acid varies with time. The reaction produces gaseous sulfur dioxide.

Which apparatus is **not** suitable?

A



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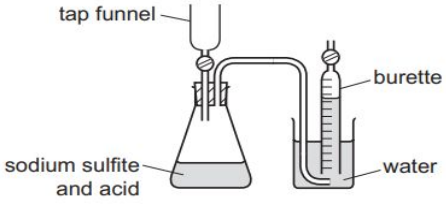

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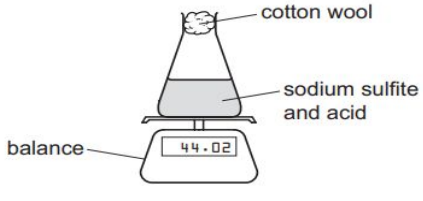

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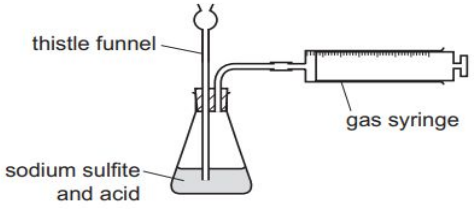
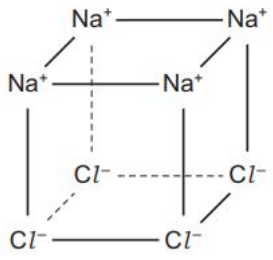


7 Which diagram correctly shows the arrangement of the ions in solid sodium chloride?

A



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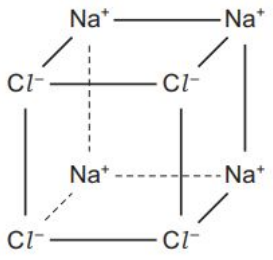

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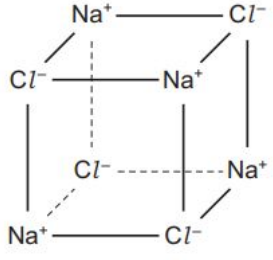
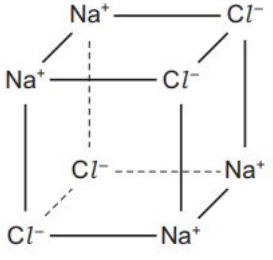


D



12 Nitrogen and oxygen react according to the equation.

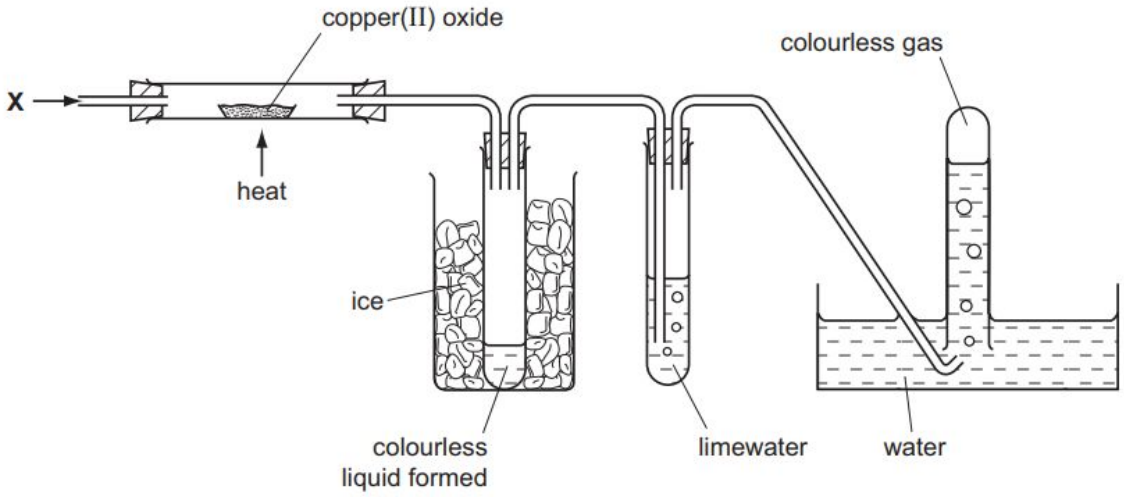
$$N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$$

The enthalpy change for the reaction shown is +66 kJ.

If two moles of nitrogen and two moles of oxygen are used, what will be the enthalpy change?

A +16.5 kJ **B** +33 kJ **C** +66 kJ **D** +132 kJ

21 When pure gas **X** was passed through the apparatus shown, the copper(II) oxide turned pink and the limewater stayed colourless.



What is gas **X**?

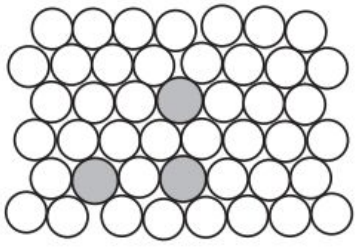
A carbon dioxide

B carbon monoxide

C hydrogen

D nitrogen

25 The diagram shows the structure of an alloy.



Which statement about alloys is correct?

A Alloys can only be formed by mixing copper or iron with other metals.

B High carbon steel alloys are soft and easily shaped.

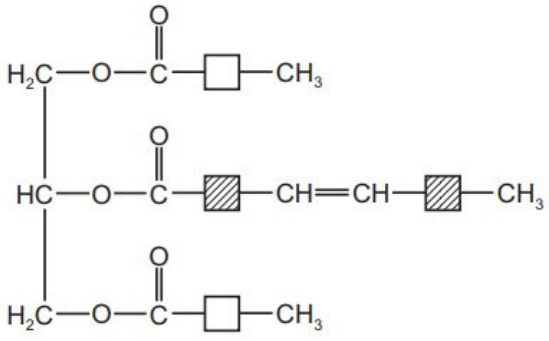
C In an alloy there is attraction between positive ions and delocalised electrons.

D The alloy brass has a chemical formula.

29 Metals usually occur in their ore combined with another element. Which metal is least likely to occur combined with another element?

A aluminium B calcium C magnesium D silver

34 The diagram shows a simplified structure of a fat.



Which compounds in the table have linkages that can be found in this fat? (Do **not** consider C–H or C-C bonds as linkages.)

	ethene	nylon	*Terylene*
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

36 Poly(ethene) is the addition polymer formed from the monomer ethene. Which statement is correct?

A Poly(ethene) can be disposed of by burning – this produces carbon dioxide and water.

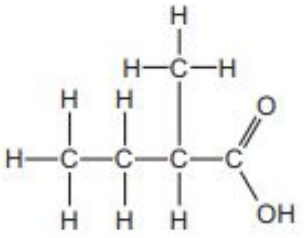
B Poly(ethene) decolourises bromine water.

C Poly(ethene) has the empirical formula C2H4.

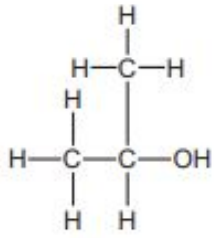
D Poly(ethene) is acted upon by bacteria so that it decomposes quickly when in a landfill site.

39 Esters are formed when an alcohol reacts with a carboxylic acid.

Which ester would be formed using the carboxylic acid and alcohol shown?

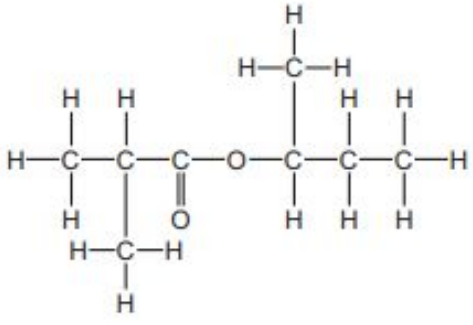


carboxylic acid

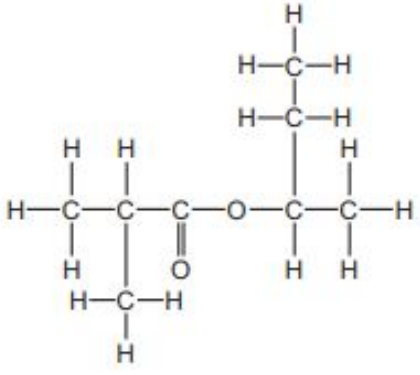


alcohol

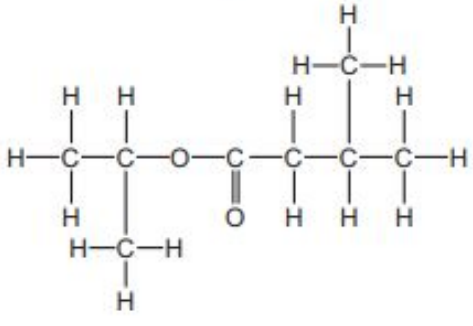
A



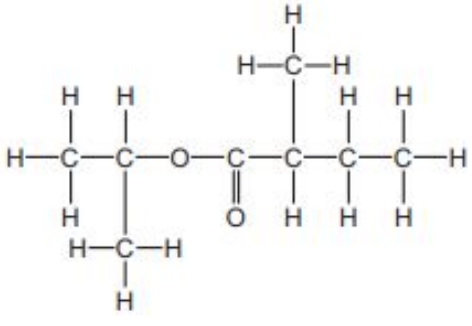
B



C



D

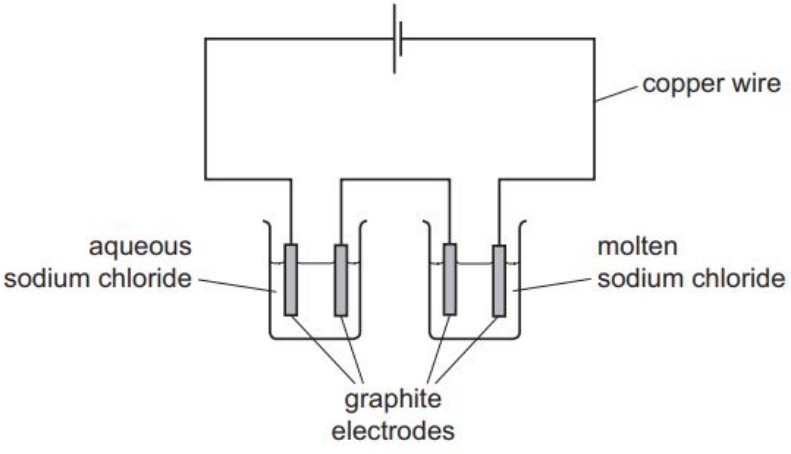


ON 2013/12

1 When drops of bromine are placed on a table-top at one side of a room, the smell of bromine can eventually be detected at the other side of the room. What is not part of the explanation of this? After evaporation, the bromine particles

A collide with air particles.
B move in a random way.
C spread out to occupy the total available space.
D vibrate from side to side

5 The diagram shows the electrolysis of aqueous sodium chloride and of molten sodium chloride.



Which substance in the diagram has both positive ions and mobile electrons?

A aqueous sodium chloride

B copper wire

C graphite electrodes

D molten sodium chloride

7 The table gives some of the properties of four substances.

Which substance could be hydrogen chloride?

	melting point /°C	boiling point /°C	ability to conduct electricity	
			when liquid	in aqueous solution
A	–114	–85	none	good
B	–114	78	none	none
C	180	218	none	(insoluble)
D	808	1465	good	good

11 The complete combustion of 20cm3 of a gaseous alkane, X, requires 130cm3 of oxygen. Both volumes were measured at r.t.p.. What could be the identity of X?

A butane B ethane C methane D propane

23 The equation shows that mixtures of hydrogen gas and iodine vapour can reach dynamic equilibrium.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Two students, X and Y, make statements about the equilibrium mixture.

X Hydrogen iodide is continually being formed and decomposed.

Y If more hydrogen is injected into the equilibrium mixture the equilibrium concentration of HI increases.

Which statements are correct?

A both X and Y

B X only

C Y only

D neither X nor Y

25 Which equation represents a redox reaction?

A $4CuO + CH_4 \rightarrow 4Cu + 2H_2O + CO_2$

B $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

C $CuCO_3 \rightarrow CuO + CO_2$

D $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$

29 Ionic compounds have high melting points because of the strong attraction between oppositely charged ions.

Which compound has the lowest melting point?

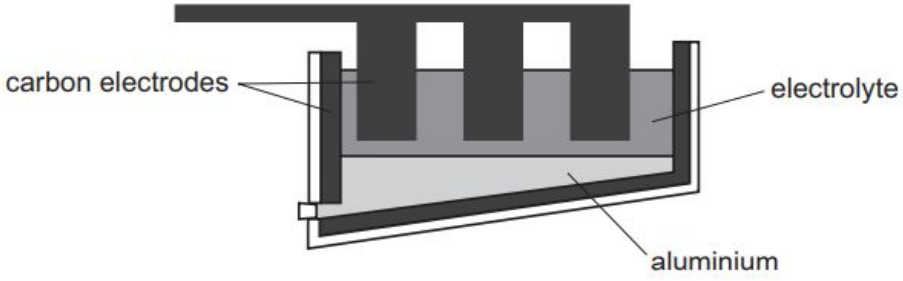
A $(Al^{3+})_2(O^{2-})_3$

B $Mg^{2+}O^{2-}$

C $Na^{+}Cl^{-}$

D $(Fe^{3+})_2(O^{2-})_3$

31 The diagram shows the apparatus needed to extract aluminium from aluminium oxide.



Which statement about this process is correct?

A The electrolyte is a solid mixture of aluminium oxide and cryolite.

B The electrolyte is aluminium oxide dissolved in water.

C The equation for the reaction at the positive electrode is $Al^{3+} + 3e^- \rightarrow Al$.

D The positive carbon electrodes lose mass during the process and need regular replacement.

MJ 2014/11

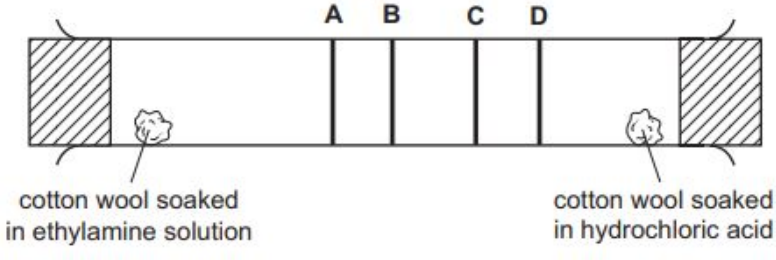
2 A radioactive isotope of carbon has more nucleons than the non-radioactive isotope, ${}^{12}_{6}C$.

How many protons, neutrons and electrons could there be in this **radioactive** isotope of carbon?

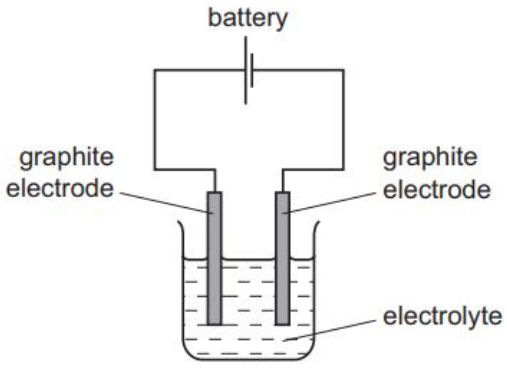
	protons	neutrons	electrons
A	6	6	6
B	6	8	6
C	8	6	8
D	8	8	8

3 Ethylamine gas, $C_2H_5NH_2$, and hydrogen chloride gas, HCl, react together to form a white solid, ethylamine hydrochloride.

At which position in the tube would a ring of solid white ethylamine hydrochloride form?



7 Graphite is often used as the electrodes in the electrolysis of solutions.



Which particles are involved in the conduction of electricity by graphite?

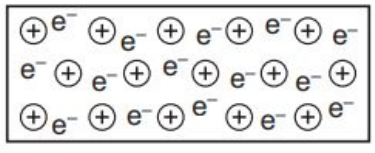
A electrons only

B negative ions only

C positive ions and electrons

D positive ions and negative ions

8 Element *X* has a lattice of positive ions and a 'sea of electrons'.



Which property will *X* have?

A It conducts electricity by the movement of ions and electrons.

B It has a high melting point.

C It is decomposed by an electric current.

D It is not malleable.

11 Aqueous potassium iodide, KI(aq), can be used as a test reagent in redox reactions.

Iodide ions are readily ……X…… . A positive result for the test is when the solution changes colour from ……Y…… to ……Z…… .

Which words correctly complete gaps X, Y and Z?

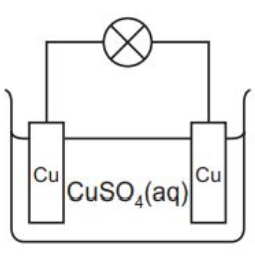
	X	Y	Z
A	oxidised	brown	colourless
B	oxidised	colourless	brown
C	reduced	brown	colourless
D	reduced	colourless	brown

14 Which statement about oxides is correct?

A A basic oxide is an oxide of a non-metal.
B Acidic oxides contain ionic bonds.
C An amphoteric oxide contains a metal.
D Basic oxides are always gases.

16 In which circuit does the bulb light?

A



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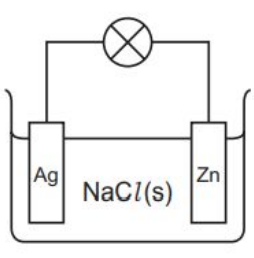
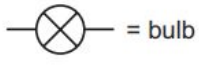
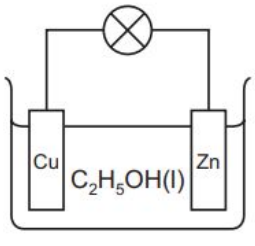


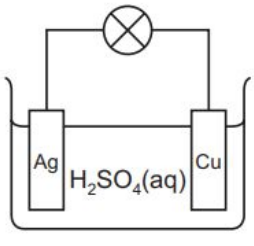
key



C

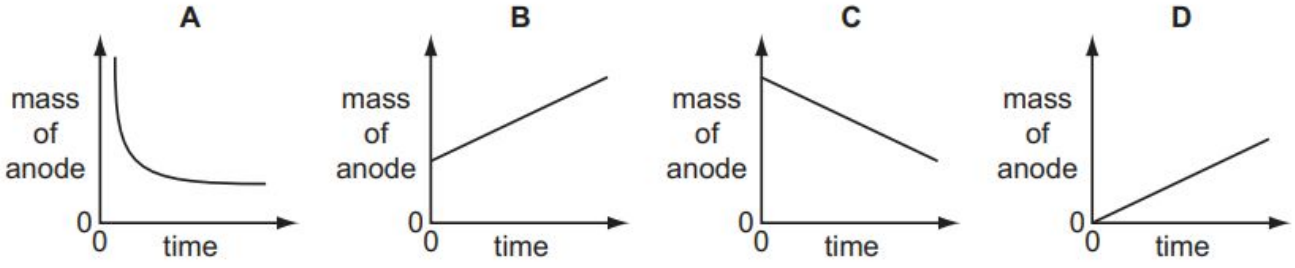


D



21 Aqueous copper(II) sulfate is electrolysed using copper electrodes. The current is constant and the anode (positive electrode) is weighed at regular intervals.

Which graph is obtained when the mass of the anode is plotted against time?



26 Which particle is found in iodine vapour?

A I **B** I^- **C** I^+ **D** I_2

29 Which of these processes can be used to purify water containing insoluble impurities?

1 chlorination	**2 desalination**	**3 distillation**	**4 filtration**

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

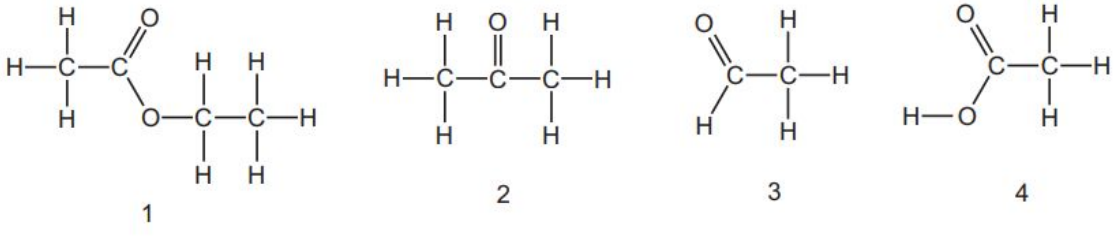
32 What is not essential for photosynthesis?

A carbon dioxide B sugar C light D water

34 Which compound, on combustion, never forms carbon?

A carbon monoxide B ethanol C ethene D methane

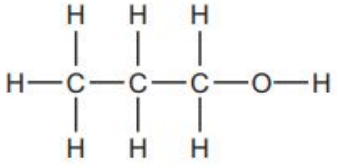
38 Four compounds are shown.



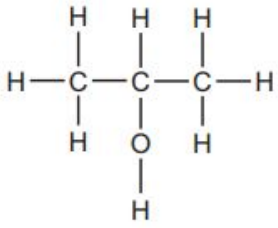
Which pair of compounds have the same empirical formula?

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

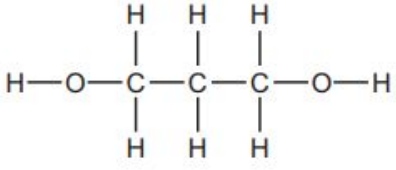
40 The structural formulae of some organic compounds are shown below.



1



2



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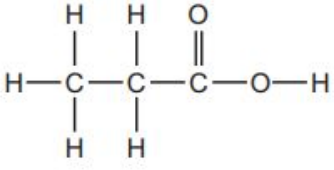


4

Which compounds are alcohols?

A 1 only

B 1 and 2 only

C 1, 2 and 3

D 4

MJ14/12

1 Which process is suitable for obtaining the water from an aqueous solution of sugar?

A crystallisation

B distillation

C filtration

D use of a separating funnel

2 Sulfur dioxide and oxygen react together.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \quad \Delta H = -197\,kJ/mol$$

Which change(s) will increase both the rate of reaction and the equilibrium concentration of SO_3?

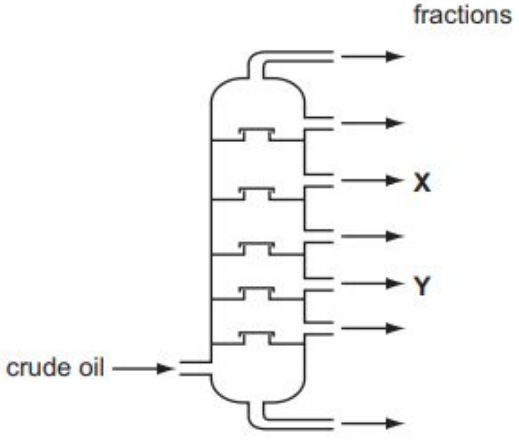
1 adding a catalyst

2 increasing temperature

3 increasing pressure

A 1 only **B** 2 **C** 1 and 3 **D** 3 only

5 Crude oil is fractionally distilled in a fractionating column. The positions at which fractions **X** and **Y** are collected are shown.



Which statement is correct?

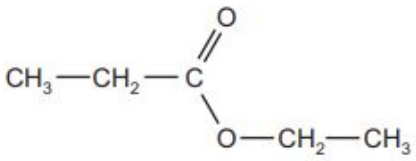
A The temperature increases up the column.

B **X** condenses at a lower temperature than **Y**.

C **X** has a higher boiling point than **Y**.

D **X** has longer chain molecules than **Y**.

9 The diagram shows the molecule ethyl propanoate.



Consider **all** the electrons in a molecule of ethyl propanoate.

How many electrons **not** involved in bonding are there in the molecule?

A 8 **B** 10 **C** 18 **D** 22

10 Sodium and magnesium are next to each other in the Periodic Table.

	melting point /°C	boiling point /°C
Na	98	883
Mg	649	1103

Which statement explains the differences in the melting and boiling points of these elements?

A Na and Mg have different types of bonding.

B The electrostatic forces of attraction are stronger in Mg.

C The ionic bonds in Mg are stronger than those in Na.

D The Mg atoms are larger than the Na atoms.

11 Sulfuric acid and potassium hydroxide can react together to form potassium hydrogensulfate, $KHSO_4$, and water only.

Which amounts of the reactants are required?

A equal masses of sulfuric acid and potassium hydroxide

B equal numbers of moles of sulfuric acid and potassium hydroxide

C 1 mol of sulfuric acid to 2 mol of potassium hydroxide

D 2 mol of sulfuric acid to 1 mol of potassium hydroxide

17 The table shows the energy released by the complete combustion of some compounds used as fuels.

compound	formula	M_r	ΔH in kJ / mol
benzene	C_6H_6	78	–3270
heptane	C_7H_{16}	100	–4800
octane	C_8H_{18}	114	–5510
propane	C_3H_8	44	–2200

Which fuel releases the least energy when 1 g of the compound is completely burned?

A benzene

B heptane

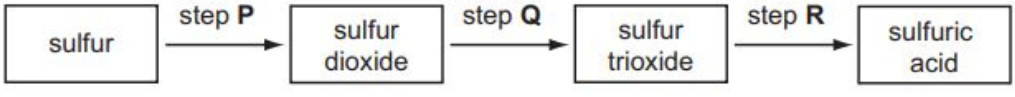
C octane

D propane

30 Which gas turns moist blue litmus paper red and produces a precipitate when bubbled through calcium hydroxide solution?

A CO **B** CO_2 **C** HCl **D** NH_3

31 The diagram shows three steps in the manufacture of sulfuric acid.



In which steps is a catalyst used?

A step **Q** only

B step **R** only

C steps **Q** and **R** only

D steps **P** and **Q** and **R**

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5 The table contains information on the structure of four particles.

particle	proton number	number of protons	number of neutrons	number of electrons
Mg	12	12	W	12
Mg^{2+}	12	12	12	X
F	Y	9	10	9
F^-	9	9	10	Z

What are the values of W, X, Y and Z in the table above?

	W	X	Y	Z
A	10	12	9	10
B	12	10	9	10
C	12	10	10	9
D	12	12	10	9

6 Which statement describes ionic bonding?

A a lattice of ions in a sea of electrons

B electrostatic attraction between oppositely charged ions

C the sharing of electrons between atoms to gain a noble gas configuration

D the transfer of electrons from atoms of a non-metal to the atoms of a metal

19 To which substance is dilute sulfuric acid added to prepare lead(II) sulfate?

A aqueous lead(II) nitrate

B lead foil

C powdered lead(II) carbonate

D powdered lead(II) oxide

21 Which statement about amphoteric oxides is not correct?

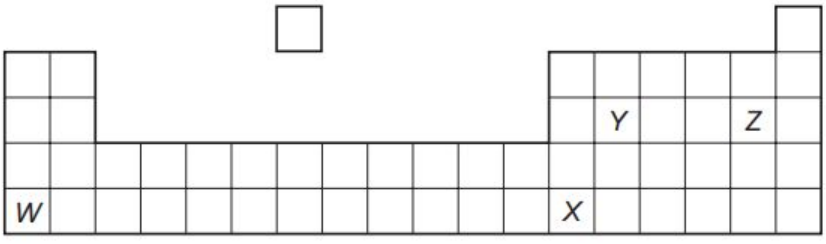
A They dissolve in water.

B They are formed only by metals.

C They react with aqueous sodium hydroxide to give salts.

D They react with aqueous acids to give salts.

23 The diagram shows an outline of part of the Periodic Table.



Which statement is **not** correct?

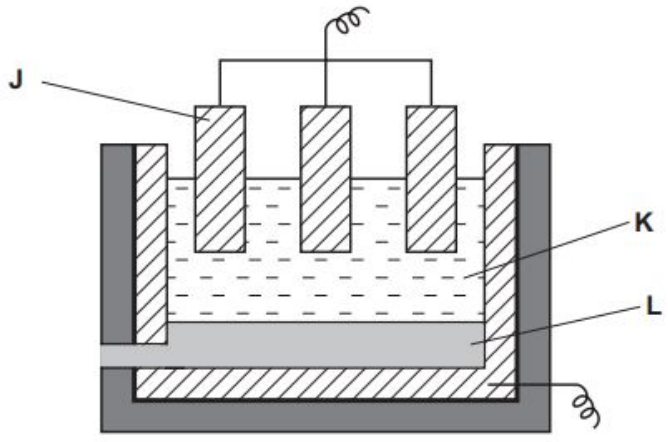
A The melting point of *W* is lower than that of *Z*.

B *W* and *Z* could react together and form a compound, *WZ*.

C *X* could form an oxide, X_2O_3.

D *Y* could form an oxide, YO_2.

24 The diagram shows apparatus that can be used to extract aluminium.



What are **J**, **K** and **L**?

	J	K	L
A	negative electrode	aluminium oxide + cryolite	aluminium
B	negative electrode	cryolite	aluminium oxide
C	positive electrode	aluminium oxide	cryolite
D	positive electrode	aluminium oxide + cryolite	aluminium

25 Sulfur is burnt in air. Which statement about this reaction is correct?

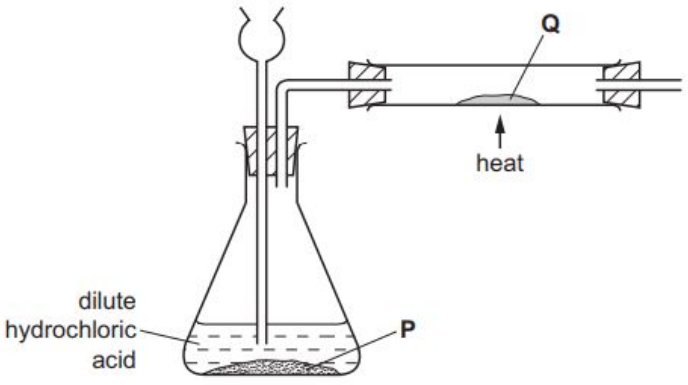
A The gas formed turns aqueous potassium dichromate(VI) from green to orange.

B The product is used as a food preservative.

C The reaction is endothermic.

D The reaction is reversible.

29 Substance **P** reacts with dilute hydrochloric acid to produce a gas.
This gas reduces substance **Q**.



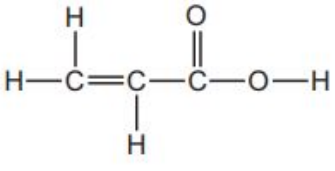
What are substances **P** and **Q**?

	P	Q
A	copper	copper(II) oxide
B	lead	lead(II) oxide
C	magnesium	zinc oxide
D	zinc	copper(II) oxide

30 Which two statements about alloys are correct? 1 Alloys are formed by mixing two metals. 2 Alloys do not conduct electricity. 3 Atoms in an alloy must all be the same size. 4 In an alloy there is metallic bonding.

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

33 A compound has the following structure.



Which reactions will occur with this compound?

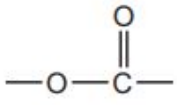
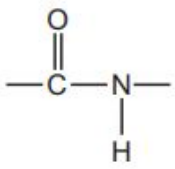
1 Bromine water will decolourise.

2 It will react with an alcohol to form an ester.

3 It will react with sodium metal.

A 1 only **B** 1 and 2 only **C** 1, 2 and 3 **D** 2 and 3 only

39 The table gives some statements about some macromolecules.

1	fats contain the linkage 	proteins contain the linkage 
2	poly(ethene) is made by addition polymerisation	*Terylene* is made by condensation polymerisation
3	starch can be hydrolysed to produce sugars	proteins can be hydrolysed to produce amino acids
4	*Terylene* is a naturally occurring polymer	nylon is a man-made polymer

Which pairs of statements are correct?

A 1 and 2 only **B** 2 and 3 only **C** 3 and 4 **D** 1, 2 and 3

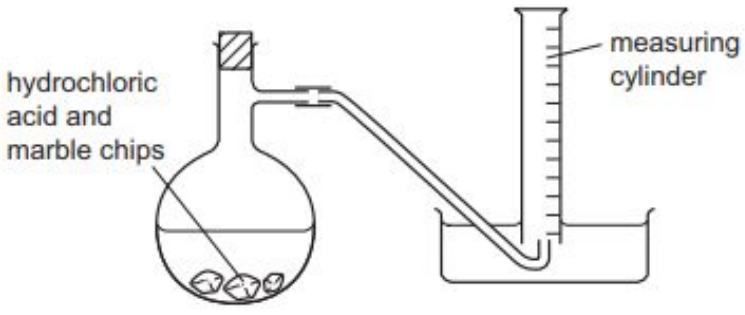
ON2014/12

1 A student wants to carry out an experiment to follow the rate of the reaction between hydrochloric acid and marble chips.

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

Which diagrams show apparatus that is suitable for this experiment?

1



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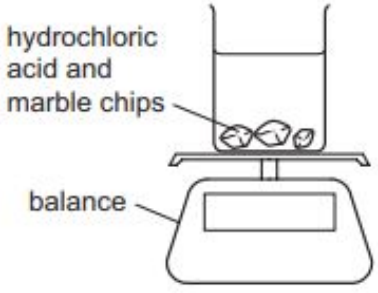

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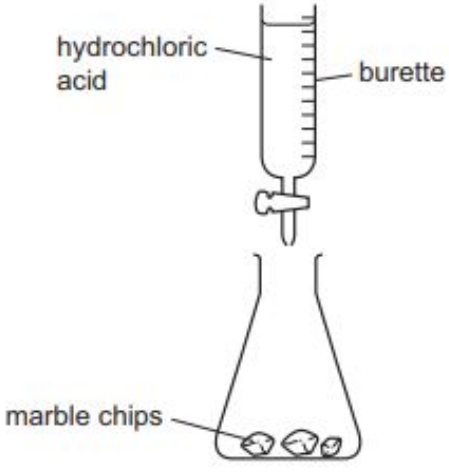

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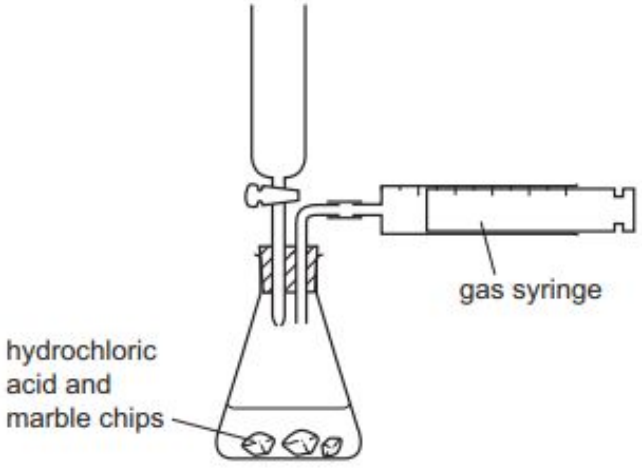


A 1 and 2 only **B** 1 and 3 only **C** 1 and 4 only **D** 1, 2 and 4

15 Which of these processes are both endothermic?

A combustion, cracking

B combustion, fermentation

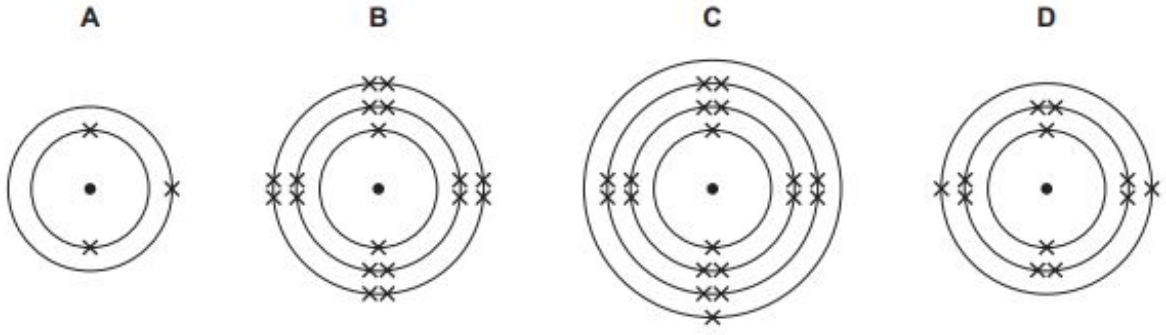
C cracking, photosynthesis

D fermentation, photosynthesis

16 Ethanol is produced by the fermentation of glucose from sugar cane. In some countries ethanol is used as a fuel. Which statements are correct?
1 Sugar cane is a non-renewable (finite) resource.
2 When sugar cane is growing it removes carbon dioxide from the atmosphere.
A 1 only B 2 only C both 1 and 2 D neither 1 nor 2

26 The diagram shows the arrangement of electrons in the atoms of four different elements.

Which is the **least** reactive of the four elements?



30 The solid carbonates of three metals, *W*, *X* and *Y*, are heated.

	result
carbonate of *W*	carbon dioxide given off solid changes colour from green to black
carbonate of *X*	carbon dioxide given off solid does not change colour
carbonate of *Y*	carbon dioxide not given off solid does not change colour

Which statements are correct?

1 Metal *Y* is more reactive than metal *X*.

2 Metal *W* is a transition metal.

3 If dilute nitric acid is added to all three carbonates, carbon dioxide is given off from the carbonates of *W* and *X* but not from the carbonate of *Y*.

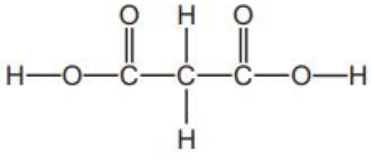
A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

32 Which row is correct for the reaction of the alkene with steam and a catalyst?

	alkene	product
A	$CH_3CH{=}CH_2$	$CH_3CH(OH)CH_3$ only
B	$CH_3CH_2CH{=}CH_2$	$CH_3CH_2CH_2CH_2OH$ only
C	$CH_3CH{=}CHCH_3$	$CH_3CH(OH)CH_2CH_3$ only
D	$(CH_3)_2C{=}CH_2$	$(CH_3)_2CHCH_2OH$ only

TIP: Wherever the C=C bonds break, the OH bonds are inserted there.

37 Which statements would be true of the compound which has the formula shown?



1 It would react with excess aqueous sodium hydroxide in a 1 : 1 molar ratio.

2 In aqueous solution, it would have a pH of 9.5.

3 It would react with an alcohol to form an ester.

A 1 only **B** 1 and 2 **C** 2 and 3 **D** 3 only

MJ 2015/11

3 Limestone reacts with hydrochloric acid. Changing which reaction condition does not affect the rate of reaction?

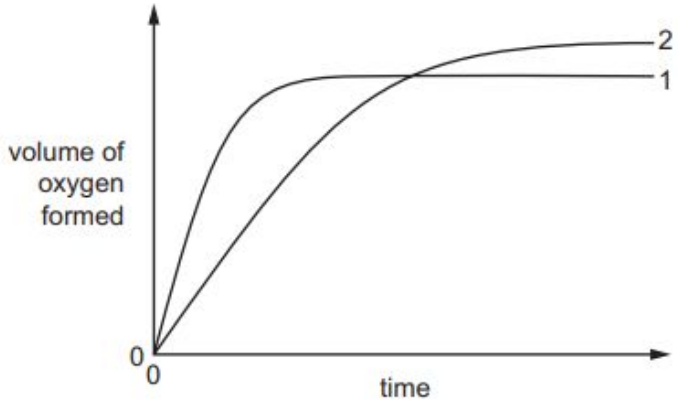
A concentration of the acid
B limestone particle size
C pressure
D temperature

7 Which compound contains only eight covalent bonds?

A	B	C	D
CH_2OH | CH_2OH	CH_2OH | CH_3	$COOH$ | $COOH$	$COOH$ | CH_2OH

16 In the graph, curve 1 was obtained by observing the decomposition of $100\,cm^3$ of $1.0\,mol/dm^3$ hydrogen peroxide solution, catalysed by manganese(IV) oxide.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$



Which alteration to the original experimental conditions would produce curve 2?

A adding some $0.1\,mol/dm^3$ hydrogen peroxide solution

B lowering the temperature

C using less manganese(IV) oxide

D using a different catalyst

39 In the addition polymer poly(propene), what is the simplest ratio of carbon atoms to hydrogen atoms?

	carbon atoms	hydrogen atoms
A	1	2
B	2	1
C	2	4
D	3	6

40 Which statement about vegetable oil and the margarine made from it is correct?
A Both are liquids at room temperature.
B Both occur naturally.
C Margarine has the higher melting point.
D Vegetable oil has fewer carbon-carbon double bonds than margarine.

MJ 2015/12

2 The concentration of aqueous sodium carbonate can be found by reaction with hydrochloric acid of known concentration using the indicator methyl orange. Which items of equipment are needed?
A burette, measuring cylinder, gas syringe
B burette, measuring cylinder, thermometer
C burette, pipette, conical flask
D burette, pipette, stopwatch

16 Hydrogen reacts with iodine to form hydrogen iodide. This is a slow reaction.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

1 mole of hydrogen gas and 1 mole of iodine vapour were mixed and allowed to react. After *t* seconds, 0.6 moles of hydrogen remained.

What is the number of moles of iodine remaining after *t* seconds?

A 0.0 **B** 0.4 **C** 0.6 **D** 1.0

17 Acidified potassium manganate(VII) is used as a test reagent.

When it is added to an aqueous solution of compound **X**, the colour of the test reagent changes from .....1..... . This colour change shows that **X** is .....2..... .

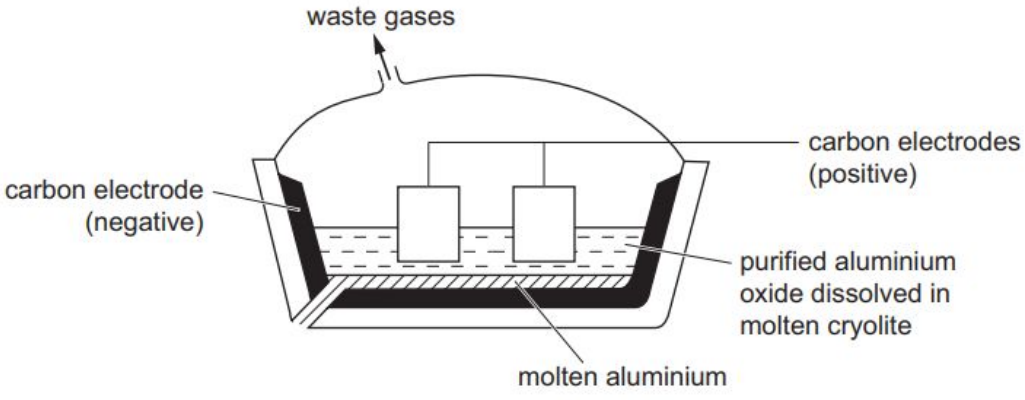
Which words correctly complete gaps 1 and 2?

	1	2
A	colourless to purple	oxidised
B	colourless to purple	reduced
C	purple to colourless	oxidised
D	purple to colourless	reduced

22 Which compound produces the greatest number of ions when 1 mole is dissolved in water?

A aluminium sulfate
B ammonium carbonate
C ammonium nitrate
D calcium nitrate

29 Aluminium is produced by the electrolysis of molten aluminium oxide.



Which statement about the process is correct?

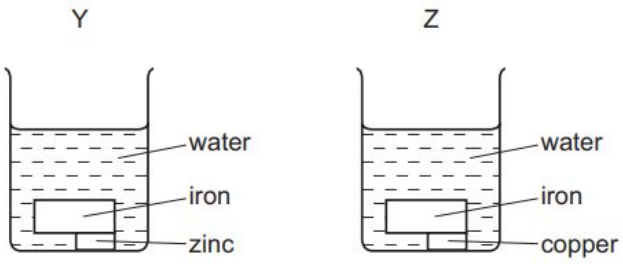
A Aluminium ions are reduced to aluminium by gaining electrons.

B Aluminium oxide is reduced by cryolite.

C Aluminium oxide is reduced by the carbon electrodes.

D Aluminium oxide is reduced by the carbon monoxide formed at the negative electrode.

32 Two pieces of iron, one with zinc attached and the other with copper attached, are placed separately in water as shown.



Which statements are correct?

1 The iron in Y will not rust.

2 The water in Z will turn blue.

3 The zinc in Y will be oxidised.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

ON2015/11

3 In a titration between an acid (in the burette) and an alkali, you may need to re-use the same titration flask. Which is the best procedure for rinsing the flask?

A Rinse with distilled water and then with the alkali.
B Rinse with tap water and then with distilled water.
C Rinse with tap water and then with the acid.
D Rinse with the alkali.

10 A metal consists of a lattice of positive ions in a 'sea of electrons'.

What happens to the electrons and positive ions in a metal wire when an electric current is passed through it?

	electrons	positive ions
A	replaced by new electrons	replaced by new ions
B	replaced by new electrons	unchanged
C	unchanged	replaced by new ions
D	unchanged	unchanged

13 Which change is endothermic?

A $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

B $H(g) + Cl(g) \rightarrow HCl(g)$

C $H_2O(g) \rightarrow 2H(g) + O(g)$

D $H_2O(l) \rightarrow H_2O(s)$

19 Which occurs during the electrolysis of dilute sulfuric acid?

A Hydrogen and oxygen are formed in the ratio two volumes of oxygen to one volume of hydrogen.

B Hydrogen is formed at the positive electrode.

C Oxide ions are oxidised to oxygen.

D The dilute sulfuric acid becomes more concentrated.

21 Which statement about graphite is not correct?

A It burns to form carbon dioxide.

B It is a carbon compound.

C It is a giant molecular substance.

D It is used as a lubricant.

25 An element is burned in an excess of oxygen. Which statement about the oxide formed is always correct?

A The mass of oxide formed is greater than the mass of element burned.
B The oxide formed is a crystalline solid.
C The oxide formed is soluble in water.
D The oxide formed is white in colour.

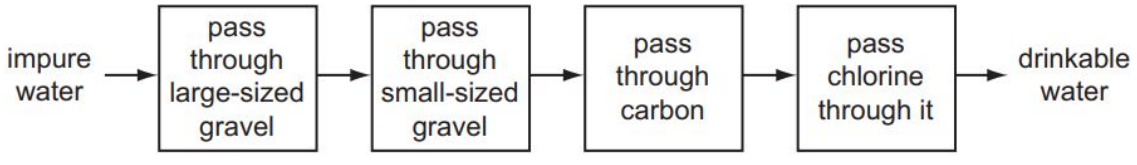
28 Three different elements react by losing electrons. The ions formed all have the electronic configuration 2,8. Which statement about these elements is correct?

A They are in the same group.
B They are in the same period.
C They are noble gases.
D They are transition elements.

29 An alloy of aluminium is used in the construction of aircraft. Why is pure aluminium never used?

A Pure aluminium cannot be manufactured.
B Pure aluminium conducts electricity.
C Pure aluminium is less dense than its alloys.
D Pure aluminium is too malleable.

31 The flow chart shows how impure water can be treated to produce drinkable water.



What is **not** removed from the water by this process?

A clay particles
B microbes
C nitrates
D odours

32 Which property of a liquid ester can be used to check its purity before use as a food flavouring?

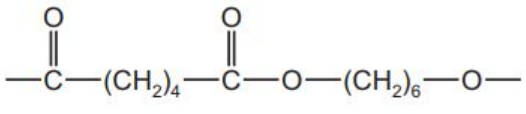
A boiling point B colour C smell D solubility in water

36 **P** is a polymer that

- has six carbon atoms in each of the monomers from which it was formed,
- is **not** a polyester,
- was formed using condensation polymerisation.

What is the partial structure of **P**?

A



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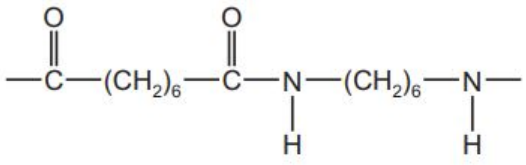

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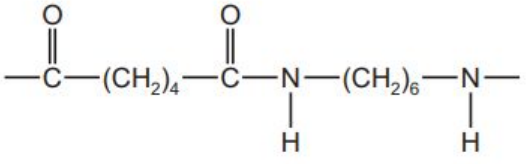
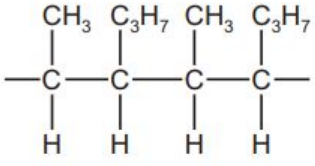


D



ON2015/12

3 Which statements are correct?

1 The volume of a gas at constant pressure increases as the temperature increases.
2 The rate of diffusion of a gas increases as the temperature increases.
3 The pressure of a gas at constant volume decreases as the temperature increases.

A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3

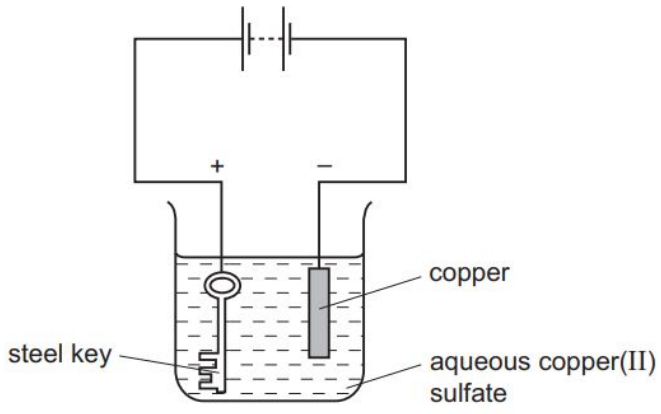
5 Which physical changes are both exothermic?

A condensation and evaporation
B evaporation and melting
C freezing and condensation
D melting and freezing

10 What is the number of moles of hydrogen atoms in 3.2 g of methane?

A 0.02 B 0.2 C 0.4 D 0.8

9 The apparatus shown is set up to plate a steel key with copper.



The key does not get coated with copper.

Which change needs to be made to plate the key?

A Increase the concentration of the aqueous copper(II) sulfate.

B Increase the voltage.

C Replace the solution with dilute sulfuric acid.

D Reverse the electrical connections.

14 A solution of sodium carbonate was added to tap water. A white precipitate formed. Which ion present in the tap water caused the precipitate to form?

A chloride B magnesium C potassium D sulfate

27 Which of the statements about iron and steel is not correct?

A Both iron and steel conduct electricity.
B Mild steel is used in car bodies.
C Pure iron is formed in the blast furnace.
D The addition of carbon to mild steel makes it stronger.

23 The reaction shown for the Haber process can reach equilibrium.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Which row shows the gases present at equilibrium?

	nitrogen	hydrogen	ammonia
A	no	no	yes
B	no	yes	yes
C	yes	no	yes
D	yes	yes	yes

24 Which statement about graphite is **not** correct?

A It burns to form carbon dioxide.

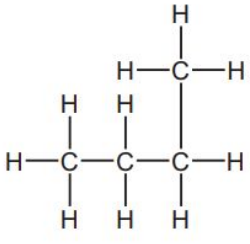
B It is a carbon compound.

C It is a giant molecular substance.

D It is used as a lubricant.

34 Which diagram shows the isomer of butane?

A



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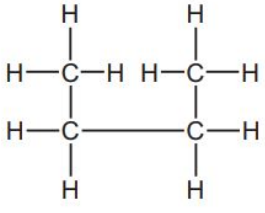

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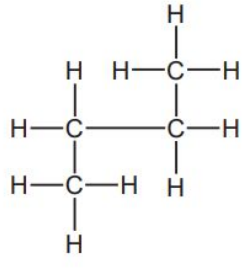

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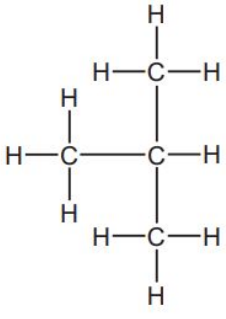
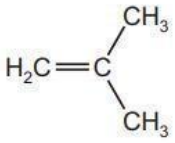
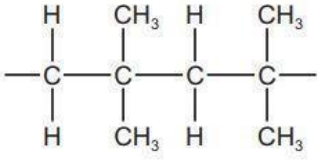


35 The diagram shows the structure of a monomer used to make a polymer.

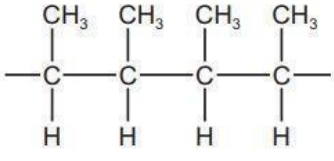


What is the structure of the polymer?

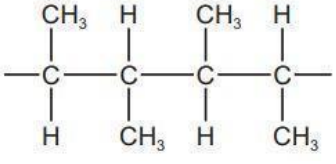
A



B



C



D