Surname	Initial(s)
Signature	

Paper Reference(s)

5017 5037

Edexcel GCSE

Additional Science (5017)

Chemistry (5037)

C2 – Topics 5 to 8

Foundation and Higher Tier

Thursday 22 November 2007 – Morning

Time: 20 minutes

Materials required for examination
Multiple Choice Answer Sheet
HB pencil, eraser and calculator

Items included with question papers
Nil

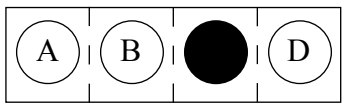
Instructions to Candidates

Use an HB pencil. Do not open this booklet until you are told to do so.
Mark your answers on the separate answer sheet.

Foundation tier candidates: answer questions 1 – 24.
Higher tier candidates: answer questions 17 – 40.
All candidates are to answer questions 17 – 24.

Before the test begins:
Check that the answer sheet is for the correct test and that it contains your candidate details.

How to answer the test:
For each question, choose the right answer, A, B, C or D and mark it in HB pencil on the answer sheet.
For example, the answer C would be marked as shown.



Mark only **one** answer for each question. If you change your mind about an answer, rub out the first mark **thoroughly**, then mark your new answer.

Do any necessary calculations and rough work in this booklet. You may use a calculator if you wish.

You must not take this booklet or the answer sheet out of the examination room.

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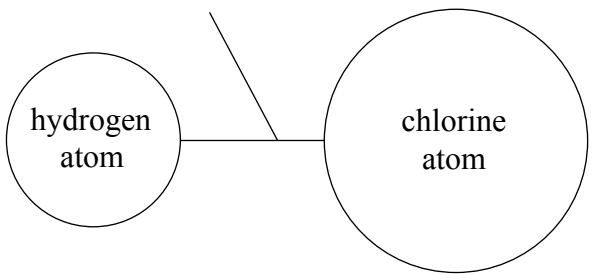
Questions 1 to 16 must be answered by Foundation tier candidates only.
Higher tier candidates start at question 17.

Elements and compounds

Elements combine to form compounds.
They do this by forming chemical bonds.

1. In a hydrogen chloride molecule, a hydrogen atom and a chlorine atom are joined by a covalent bond.



The covalent bond contains

A ions
B neutrons
C protons
D electrons

2. All atoms of chlorine contain the same number of

A ions
B molecules
C neutrons
D protons

3. The symbol for an atom of chlorine is

A CL
B Cl
C cl
D cL

4. A sodium atom can be represented as Na.
A sodium ion can be represented as Na^+
To form a sodium ion the sodium atom must

A lose an electron
B gain an electron
C share an electron
D gain a proton

Use this information to answer questions 5 and 6.

When hydrogen burns, water is formed.
The equation for the reaction is

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

5. The equation shows that water is formed as a

A solid
B liquid
C gas
D solution

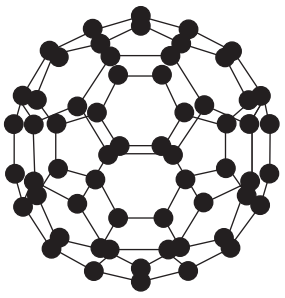
6. What is the relative formula mass of water?
(Relative atomic masses: H = 1, O = 16)

A 17
B 18
C 33
D 36

7. Which of these substances is a simple molecular, covalent compound?

substance	melting point (°C)	boiling point (°C)
A	755	1390
B	–75	–10
C	318	1390
D	1610	2230

8. The diagram shows a model of a molecule of buckminsterfullerene which contains 60 carbon atoms.



Buckminsterfullerene is

A an element
B an ionic compound
C a covalent compound
D a mixture

Useful materials

9. Coal is burned to produce heat.
This reaction is

A exothermic
B endothermic
C a physical change
D temporary

10. Plastic carrier bags are usually made from the polymer poly(ethene)
All polymers are

A naturally occurring
B made from small molecules
C made from plants
D difficult to dispose of

11. Disposing of most plastic carrier bags can cause problems.
This is because they

A cannot be burnt
B do not rot
C cannot be reused
D are biodegradable

12. Argon is a noble gas that is used in light bulbs because it is very unreactive.
Argon is unreactive because its atom

A has eight electrons in its outer shell
B has a full outer shell of protons
C has four electrons in its outer shell
D has four protons in its outer shell

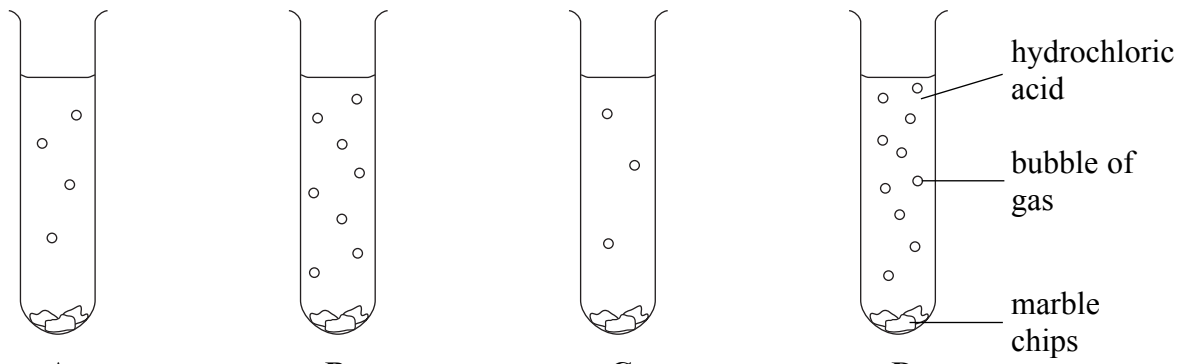
13. The tungsten metal in light bulbs conducts electricity because particles move through its structure.
These particles are

A protons
B neutrons
C electrons
D ions

Speeding up reactions

Use this information to answer questions 14, 15 and 16.

Dave added marble chips to hydrochloric acid in four test tubes.



14. In which tube is the reaction slowest?

15. Which of these would **not** speed up the reactions?

A warming the tubes
B using a more concentrated acid
C using the same mass of smaller marble chips
D adding water to the tubes

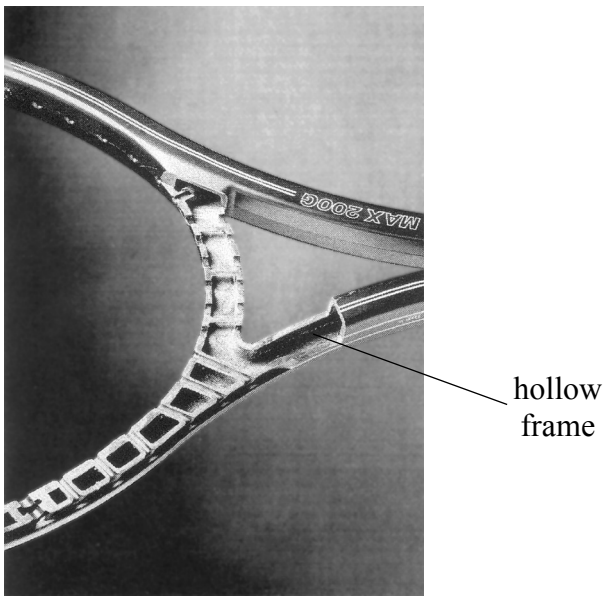
16. Dave wonders if he could use a catalyst in this reaction.
Which row of the table describes a catalyst and its effect?

	mass of catalyst after the reaction	**changes the rate of the reaction**
A	has decreased	no
B	has stayed the same	yes
C	has stayed the same	no
D	has decreased	yes

Higher tier candidates start at question 17 and answer questions 17 to 40.
Questions 17 to 24 must be answered by all candidates: Foundation tier and Higher tier

Tennis rackets

Some modern tennis rackets have hollow frames made of a thermoplastic material reinforced with carbon fibres.
The hollow in the frame is created using a core made from a low melting point alloy. When the frame is complete this alloy is melted and poured out of the frame.



(Source: *Which Materials*, The Institute of Materials, 1990)

17. Which row of the table describes a thermoplastic?

	softened by heating	**cross links between chains**
A	yes	no
B	no	yes
C	yes	yes
D	no	no

18. Plasticisers are sometimes added to plastics to alter their properties.
A plasticiser

A increases cross links between chains
B decreases cross links between chains
C makes the plastic more rigid
D makes the plastic more flexible

19. The materials used to make many thermoplastics are obtained from crude oil.
One process involves the cracking of fractions obtained from crude oil.
Which of these is **not** correct?

A Cracking gives products that are more useful than the fractions which are cracked
B Cracking produces alkanes and alkenes
C Cracking forms polymers
D The molecules that are cracked are hydrocarbons

20. Which of these describes an alloy?

A a very pure form of a metal
B a metal that has carbon fibres mixed with it
C a metal that has another metal mixed with it
D a metal which is a mixture of isotopes of the same metal

21. Aluminium is a metal often found in alloys.
Its atomic number is 13.
What is the electronic configuration of an aluminium atom?

A 3.8.2
B 2.3.8
C 2.8.3
D 2.10.1

22. Diamond and graphite are two forms of carbon.
Which row of the table is correct for diamond and graphite?

	diamond	**graphite**
A	very hard	conducts electricity
B	conducts electricity	very hard
C	very hard	low melting point
D	conducts electricity	high melting point

Alkali metals

The alkali metals all react with water.

23. The balanced equation for the reaction of lithium with water is

A	Li	+	H_2O	$\rightarrow$	LiO	+	H_2
B	Li	+	$2H_2O$	$\rightarrow$	LiO_2	+	$2H_2$
C	Li	+	$2H_2O$	$\rightarrow$	$Li(OH)_2$	+	H_2
D	2Li	+	$2H_2O$	$\rightarrow$	2LiOH	+	H_2

24. The reactions of all the alkali metals with water are similar.
This is because an atom of every alkali metal contains the same number of

A electrons in the outer shell
B electrons orbiting the nucleus
C protons in the nucleus
D neutrons in the nucleus

TOTAL FOR FOUNDATION TIER PAPER: 24 MARKS

Foundation tier candidates do not answer any more questions after question 24.

Questions 25 to 40 must be answered by Higher tier candidates only.
Foundation tier candidates do not answer questions 25 to 40.

Metals

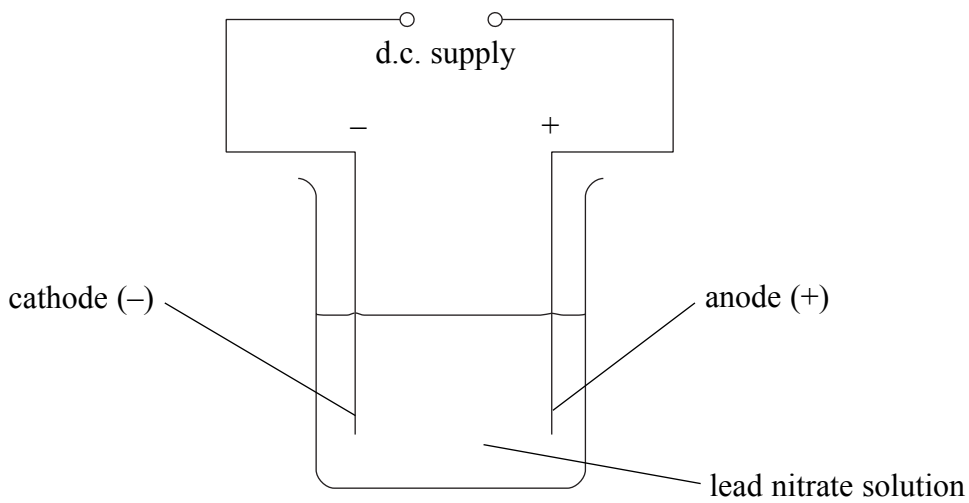
25. Sodium reacts with chlorine to form sodium chloride.
The balanced equation for this reaction is

A $Na + Cl \rightarrow NaCl$
B $Na + Cl_2 \rightarrow NaCl_2$
C $2Na + Cl \rightarrow Na_2Cl$
D $2Na + Cl_2 \rightarrow 2NaCl$

26. Which row of the table shows the structure and electrical conductivity of sodium chloride?

	structure	**conducts electricity when**		
		in solution	**molten**	**solid**
A	ionic	yes	yes	no
B	simple molecular covalent	no	yes	no
C	giant molecular covalent	yes	yes	no
D	ionic	yes	yes	yes

27. Lead metal can be obtained from lead nitrate solution by electrolysis.



During this process

A lead ions move to the cathode and gain electrons
B lead ions move to the anode and gain electrons
C lead atoms move to the cathode and lose electrons
D lead atoms move to the anode and lose electrons

28. 24.0 g of titanium reacted with 71.0 g of chlorine.
What is the empirical formula of the compound formed?
(Relative atomic masses: Cl = 35.5, Ti = 48.0)

A $TiCl_2$
B Ti_2Cl
C $TiCl_4$
D Ti_4Cl

29. Iron catalyses the reaction between nitrogen and hydrogen to form ammonia.
Three statements about the action of this catalyst are listed.

1 More ammonia is obtained at equilibrium when more catalyst is used.
2 The catalyst increases the rate of reaction between nitrogen and hydrogen.
3 When the reaction is complete, the mass of the catalyst has not changed.

Which of these statements are correct?

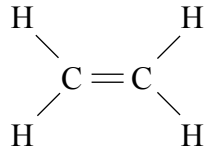
A 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

30. Naturally occurring nickel contains two isotopes.
70% of the atoms are nickel-58 and 30% are nickel-60.
The relative atomic mass of nickel is

A 58.6
B 59.0
C 59.4
D 59.6

Alkenes

31. The structure of an ethene molecule is shown.

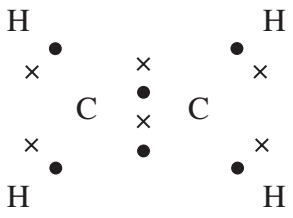
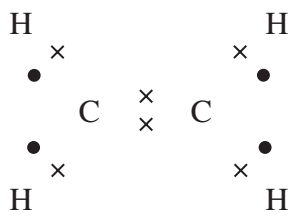
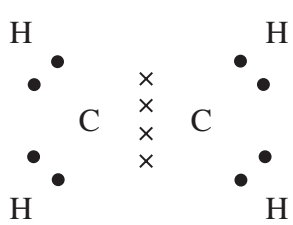
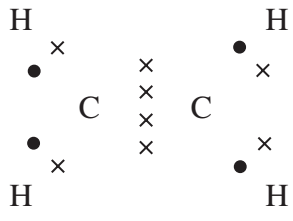


Which row of the table correctly describes ethene?

	saturated molecule	hydrocarbon
A	no	no
B	no	yes
C	yes	no
D	yes	yes

32. Which of these dot and cross diagrams correctly represents a molecule of ethene?

× represents an electron from a carbon atom
● represents an electron from a hydrogen atom

A	
B	
C	
D	

33. In industry, ethene is reacted with steam to form ethanol.

$$C_2H_4 + H_2O \rightleftharpoons C_2H_5OH$$

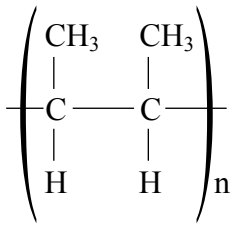
In this reaction 2800 tonnes of ethene produce 230 tonnes of ethanol.
Which of the following statements about this reaction are true?

1 The theoretical atom economy of the reaction is 100%.
2 The percentage yield is 5%.

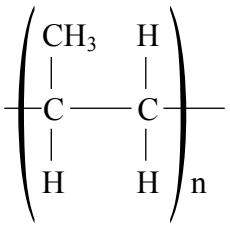
(Relative formula masses: $C_2H_4 = 28$, $C_2H_5OH = 46$)

A 1 only
B 2 only
C both 1 and 2
D neither 1 nor 2

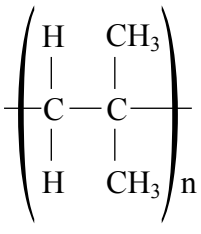
34. Ethene and propene are alkenes.
Which formula shows the structure of poly(propene)?



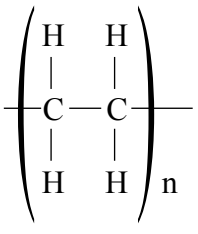
A



B



C

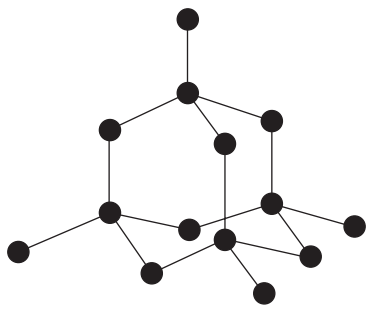


D

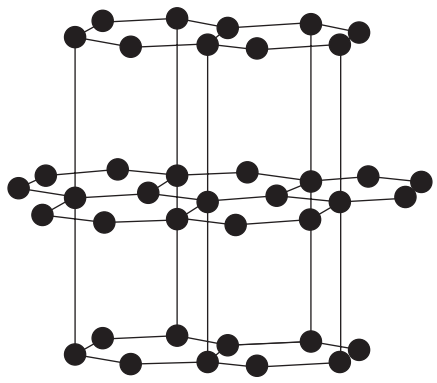
Carbon

Use this information to answer questions 35 and 36.

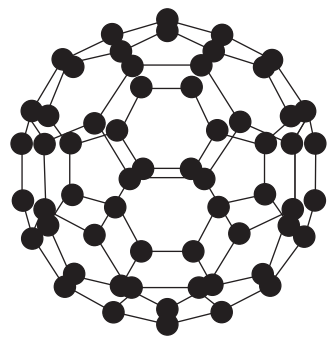
The diagrams show the structures of three forms of carbon.



diamond



graphite



buckminsterfullerene

Buckminsterfullerene was discovered whilst scientists were carrying out research into carbon-rich stars.
They fired a laser beam at graphite and produced clusters of carbon atoms.
The main cluster contained 60 carbon atoms.

35. Which statement is true?

A Buckminsterfullerene has an unstable structure
B Buckminsterfullerene was discovered by chance
C Scientists carrying out the experiment were trying to make buckminsterfullerene
D Buckminsterfullerene can only exist in carbon-rich stars

36. Buckminsterfullerene conducts electricity.
This is because

A it has a smaller structure than diamond
B every carbon atom is bonded to three others leaving free electrons
C every carbon atom is bonded to three others forming ions
D it is made from graphite

37. Carbon combines with oxygen to form carbon dioxide.
Carbon dioxide is a gas at room temperature.
Which row of the table is correct for carbon dioxide?

	type of structure	strength of forces between molecules	strength of bonds between atoms
A	simple molecular covalent	strong	strong
B	simple molecular covalent	strong	weak
C	giant molecular covalent	weak	strong
D	simple molecular covalent	weak	strong

Making ammonia

Use this information to answer questions 38, 39 and 40

Ammonia is manufactured by the Haber process, using an iron catalyst.
The reaction can be represented by

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

The forward reaction is exothermic.

38. This reaction is described as reversible because

A a high temperature is needed to make ammonia
B the forward reaction is helped by an increase in pressure
C some ammonia formed decomposes into nitrogen and hydrogen
D the substances in the reaction are all gases

39. The yield of ammonia can be changed by increasing the temperature or increasing the pressure on the equilibrium mixture.
Which row of the table correctly shows the effects of the changes on equilibrium yield?

	increasing temperature	increasing pressure
A	increases yield	increases yield
B	decreases yield	increases yield
C	increases yield	decreases yield
D	decreases yield	decreases yield

40. These are statements about the forward reaction.

1 It is exothermic because the total energy required to break the bonds is less than the total energy released when the new bonds are formed.
2 It is exothermic because using a catalyst speeds up the reaction.

Which of these statements are correct?

A 1 only
B 2 only
C both 1 and 2
D neither 1 nor 2

TOTAL FOR HIGHER TIER PAPER: 24 MARKS

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