

# CHEMISTRY

0620 P3

2017 — 2024

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# CHAPTER 1

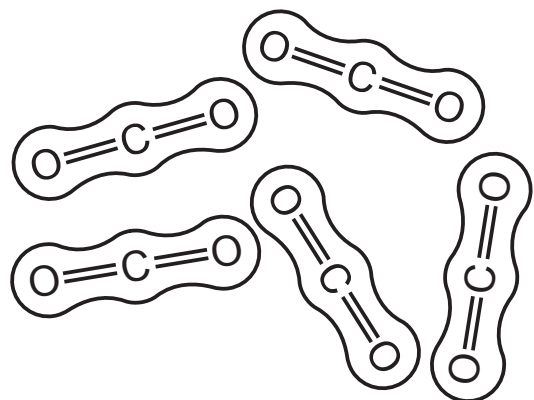
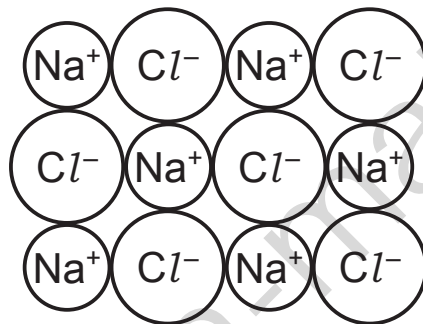
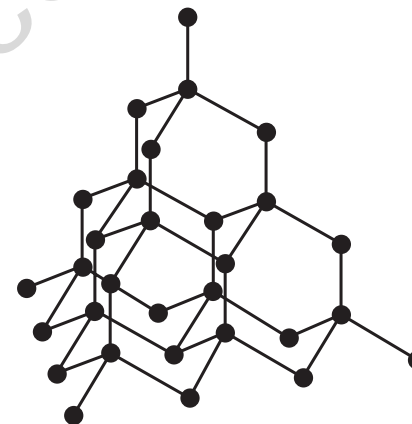
## STATES OF MATTER

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1 - (0620/31\_Summer\_2017\_Q3)

ANSWER

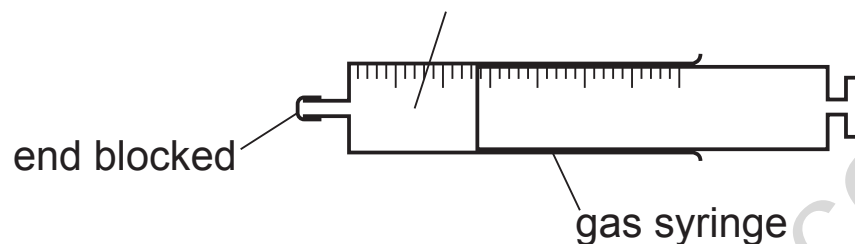
The diagram shows part of the structures of three substances, **X**, **Y** and **Z**, at room temperature and pressure.

**X****Y****Z**

(a) Describe substances **X**, **Y** and **Z** in terms of

- their bonding,
- the arrangement of their particles,
- the motion of their particles.





Describe what happens to the volume of substance **X** in the syringe when the pressure is increased. The temperature remains constant. Explain your answer in terms of particles.

.....

..... [2]

(c) Substance **Z** is diamond. Diamond is used in jewellery.

Give **one** other use of diamond.

..... [1]

(d) Substance **Y** undergoes physical and chemical changes.

Which **two** of the following are physical changes? Explain your answer.

- A** Substance **Y** dissolves easily in water.
- B** An aqueous solution of substance **Y** gives a white precipitate with acidified aqueous silver nitrate.
- C** Substance **Y** melts at  $801\text{ }^{\circ}\text{C}$ .
- D** Substance **Y** reacts with concentrated sulfuric acid.

.....

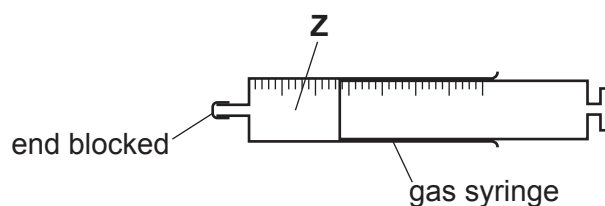
.....

..... [3]

[Total: 11]



(b) A closed gas syringe contains substance **Z**.



Describe what happens to the volume of substance **Z** in the syringe when the temperature is increased. The pressure remains constant. Explain your answer in terms of particles.

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

(c) Describe the colour change when substance **Y** is added to anhydrous copper(II) sulfate.

..... [2]

(d) Give a reason why substance **Y** is a compound.

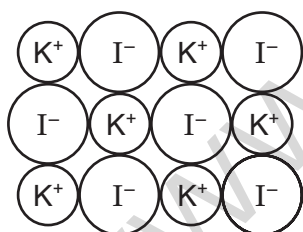
..... [1]

[Total: 10]

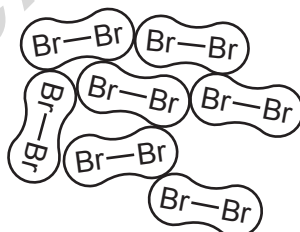
3 - (0620/33\_Summer\_2017\_Q3)

ANSWER

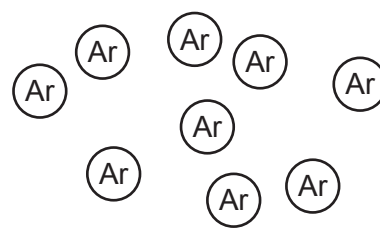
The diagram shows part of the structures of three substances, **P**, **Q** and **R**, at room temperature and pressure.



**P**



**Q**



**R**

(a) Describe substances **P**, **Q** and **R** in terms of

- their bonding,
- the arrangement of their particles,
- the motion of their particles.

.....  
 .....  
 .....





- (d) Graphite has a giant covalent structure containing layers of carbon atoms. Graphite is used to make inert electrodes for electrolysis.

State **one** other use of graphite and explain how this use is related to its structure.

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

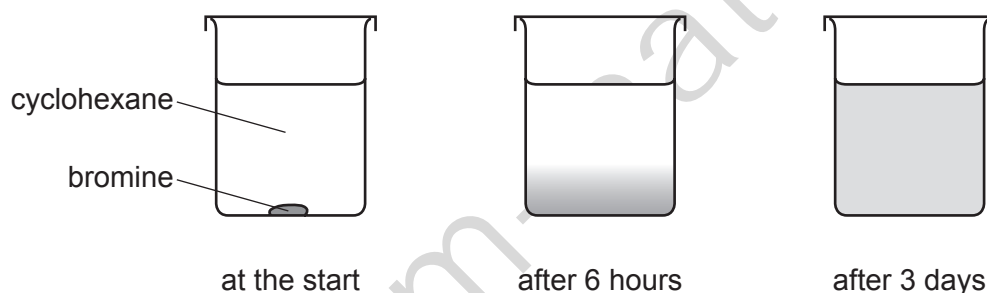
[Total: 12]

4 - (0620/31\_Winter\_2017\_Q7)

**ANSWER**

Bromine is a red-brown liquid which is soluble in cyclohexane.

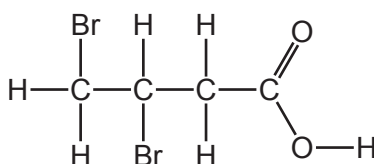
- (a) A few drops of liquid bromine were placed at the bottom of a beaker containing cyclohexane. After 3 days, a red-brown colour had spread throughout the beaker.



Explain these observations using the kinetic particle model.

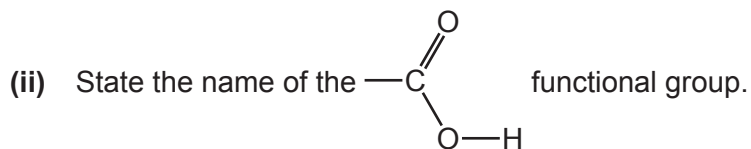
.....  
 .....  
 .....  
 .....  
 ..... [3]

- (b) The structure of a compound containing bromine is shown.



- (i) Deduce the molecular formula of this compound showing the number of carbon, hydrogen, oxygen and bromine atoms.

..... [1]



..... [1]

- (c) The relative atomic mass of bromine is 80.

Complete the definition of relative atomic mass using terms from the list.

6

12

an atom

an element

a molecule

average

carbon

hydrogen

total

Relative atomic mass is the ..... mass of naturally occurring atoms  
of ..... on a scale where ..... of the  $^{12}\text{C}$  isotope has  
a mass of exactly ..... units. [4]

- (d) Dilute hydrobromic acid reacts with magnesium ribbon.

- (i) Suggest **three** ways of increasing the rate of this reaction.

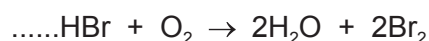
1 .....

2 .....

3 ..... [3]

- (ii) Hydrobromic acid reacts with oxygen. The products are water and bromine.

Balance the chemical equation for this reaction.



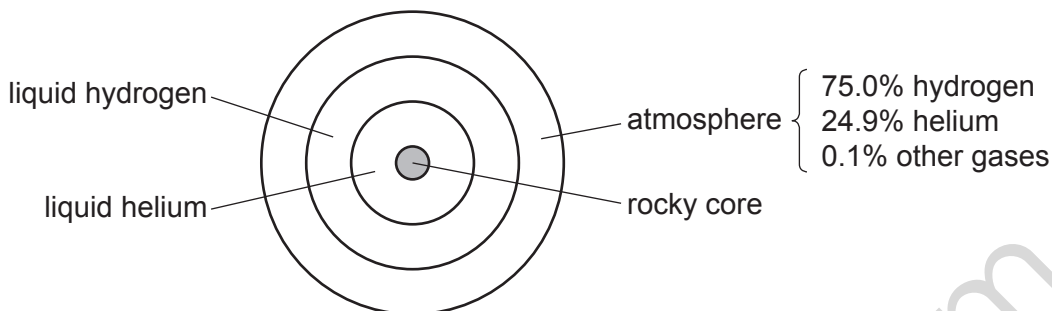
[1]

[Total: 13]

5 - (0620/32\_Winter\_2017\_Q2)



The diagram shows the composition of the planet Saturn.



(a) Describe how Saturn's atmosphere differs from the Earth's atmosphere. Give **three** differences.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) Some properties of hydrogen and helium are given in the table.

element	density of the liquid in g/cm <sup>3</sup>	melting point in °C	boiling point in °C
hydrogen	0.07	-259	-253
helium	0.15	-272	-269

(i) Use the information to suggest why the layer of liquid hydrogen in Saturn floats on top of the liquid helium.

..... [1]

(ii) What is the physical state of hydrogen at -250 °C? Explain your answer.

.....

..... [2]

(c) The atmosphere of Saturn contains small amounts of ammonia.

(i) Describe a test for ammonia.

test .....

result .....

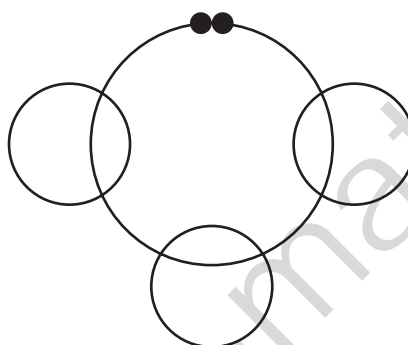
[2]

(ii) Ammonia is a covalent compound.

Complete the diagram to show

- the arrangement of electrons in a molecule of ammonia,
- the symbols of the atoms present.

Show outer electrons only.



[2]

(d) Saturn's atmosphere also contains small amounts of ammonium hydrosulfide.

Calculate the relative molecular mass of ammonium hydrosulfide,  $\text{NH}_4\text{SH}$ .  
Use your Periodic Table to help you.

relative molecular mass = ..... [2]

(e) Saturn's atmosphere also contains small amounts of methane.

Small amounts of methane are present in the Earth's atmosphere.  
Methane is a greenhouse gas.

(i) Name another greenhouse gas present in the Earth's atmosphere.

..... [1]

(ii) Scientists are concerned about the increase in the amount of greenhouse gases in the Earth's atmosphere.

Explain why.

..... [1]

[Total: 14]

1 - (0620/31\_Summer\_2017\_Q3)



(a)	<p>any 5 of:</p> <p><b>X</b> has covalent bonding</p> <p><b>X</b> particles are randomly arranged / irregularly arranged</p> <p><b>X</b> particles are moving rapidly / freely / randomly / irregularly</p> <p><b>Y</b> has ionic bonding / ionic</p> <p><b>Y</b> particles are regularly arranged / lattice / in rows / uniformly arranged</p> <p><b>Y</b> particles (only) vibrate / do not move from place to place</p> <p><b>Z</b> has covalent bonding</p> <p><b>Z</b> particles are regularly arranged / lattice / in a tetrahedral shape</p> <p><b>Z</b> particles (only) vibrate / do not move from place to place</p>	<b>5</b>
(b)	volum gets smaller	<b>1</b>
	particles get closer together	<b>1</b>
(c)	drill tips / drills / cutting (tools)	<b>1</b>
(d)	<b>A</b> / substance <b>Y</b> dissolves easily in water	<b>1</b>
	<b>C</b> / substance <b>Y</b> melts (at 8015 °C)	<b>1</b>
	the change can be reversed by altering the conditions	<b>1</b>

2 - (0620/32\_Summer\_2017\_Q3)



(a)	any 5 of: <b>X</b> has ionic bonding / ionic <b>X</b> particles are regularly arranged / lattice / in rows / uniformly arranged <b>X</b> particles (only) vibrate / do not move from place to place  <b>Y</b> has covalent bonding <b>Y</b> has irregular arrangement of particles / random arrangement <b>Y</b> particles are sliding over each other / moving slowly  <b>Z</b> has covalent bonding <b>Z</b> particles are randomly arranged / irregularly arranged <b>Z</b> particles moving randomly / moving rapidly / moving freely / moving quickly / moving fast	<b>5</b>
(b)	volume increases / volume gets larger	<b>1</b>
	particles get further apart	<b>1</b>
(c)	white	<b>1</b>
	to blue	<b>1</b>
(d)	it has (two different types of) <u>atoms bonded / joined</u>	<b>1</b>

## 3 - (0620/33\_Summer\_2017\_Q3)



(a)	<p>any 5 of:</p> <p><b>P</b> has ionic bonding / ionic</p> <p><b>P</b> particles are regularly arranged / lattice / in rows / uniformly arranged</p> <p><b>P</b> particles (only) vibrating / not moving from place to place</p> <p><b>Q</b> has covalent bonding</p> <p><b>Q</b> has irregular arrangement of particles / random arrangement</p> <p><b>Q</b> particles moving slowly / moving randomly / sliding over each other</p> <p><b>R</b> no bonding (between atoms) / weak bonding between atoms / weak attractive forces between atoms</p> <p><b>R</b> has irregular arrangement of particles / random arrangement</p> <p><b>R</b> particles moving randomly / moving rapidly / freely moving / randomly (moving) / irregular (movement)</p>	<b>5</b>
(b)	volume increases	<b>1</b>
	particles get further apart	<b>1</b>
(c)	<b>C</b> / boils (at 1330 °C)	<b>1</b>
	<b>D</b> / dissolves (readily in water)	<b>1</b>
	the change can be reversed by altering the conditions	<b>1</b>
(d)	pencil (leads) / lubricant	<b>1</b>
	layers move <b>OR</b> slide over each other	<b>1</b>



## 4 - (0620/31\_Winter\_2017\_Q7)



(a)	any 3 from: <ul style="list-style-type: none"> <li>• diffusion</li> <li>• molecules move (from place to place)</li> <li>• (molecules move) randomly</li> <li>• molecules collide</li> <li>• molecules spread out / mix up</li> <li>• (bulk) movement of molecules from areas of where they are at higher concentration to where they are at lower concentration</li> </ul>	<b>3</b>
(b)(i)	$C_4H_6O_2Br_2$	<b>1</b>
(b)(ii)	carboxylic acid	<b>1</b>
(c)	average	<b>1</b>
	an element	<b>1</b>
	an atom	<b>1</b>
	12	<b>1</b>
(d)(i)	increasing the concentration of the <u>acid</u>	<b>1</b>
	increasing the temperature	<b>1</b>
	using <u>magnesium</u> powder / using smaller pieces of <u>magnesium</u>	<b>1</b>
(d)(ii)	4 (HBr)	<b>1</b>

## 5 - (0620/32\_Winter\_2017\_Q2)



(a)	any 3 from: <ul style="list-style-type: none"> <li>• greater percentage of helium (on Saturn) / less helium on Earth</li> <li>• greater percentage of hydrogen (on Saturn) / little hydrogen on Earth</li> <li>• no oxygen on Saturn / oxygen on Earth / Earth has 1/5 oxygen</li> <li>• lower percentage of other gases (on Saturn) / more of other gases on Earth</li> <li>• greater percentage of argon on Earth / less argon on Saturn</li> <li>• no <b>OR</b> very little nitrogen on Saturn / Earth has about 80% nitrogen / Earth has a lot of nitrogen</li> </ul>	<b>3</b>
(b)(i)	hydrogen is less dense than helium	<b>1</b>
(b)(ii)	gas	<b>1</b>
	-250 °C is above the boiling point	<b>1</b>
(c)(i)	(damp) <u>red</u> litmus	<b>1</b>
	turns blue	<b>1</b>
(c)(ii)	labels 'N' and 'H' in the correct circles	<b>1</b>
	one pair of electrons in each overlap area and no non-bonding electrons or extra bonding electrons added	<b>1</b>
(d)	51 IF full credit is not awarded, allow 1 mark for (S =) 32, (N =) 14 and (H =) 1	<b>2</b>
(e)(i)	carbon dioxide / CO <sub>2</sub>	<b>1</b>
(e)(ii)	global warming / effect of global warming, e.g. melting ice caps / desertification / more extreme weather / death of corals / more risk of flooding	<b>1</b>

6 - (0620/32\_Winter\_2017\_Q7)



(a)	any 3 from: <ul style="list-style-type: none"><li>• diffusion</li><li>• molecules move (from place to place)</li><li>• (molecules move) randomly</li><li>• molecules collide</li><li>• molecules spread out / mix up</li><li>• (bulk) movement of molecules from areas of where they are at higher concentration to where they are at lower concentration</li></ul>	<b>3</b>
(b)	$Cl_2$	<b>1</b>
	2 ( $SCl_2$ )	<b>1</b>
(c)	<b>P:</b> freezing	<b>1</b>
	<b>Q:</b> condensing / condensation	<b>1</b>