Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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The Periodic Table

Time allowed: 40 minutes

Subject code **0620**

Chemistry

Questions from Paper 1, Paper 2, Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 40

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 40 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

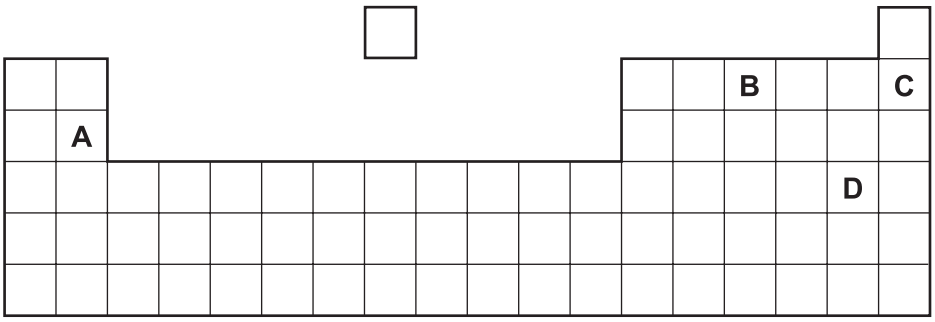
- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 Part of the Periodic Table is shown.

Which element conducts electricity?



Arrangement of the Periodic Table and trends Click for more variations

Answer A

2 Elements J and K are in the same period in the Periodic Table.

J reacts with acids to produce a salt and hydrogen.

K reacts with sodium to form an ionic compound.

Which statement about J and K is correct?

A An atom of J has more electrons than an atom of K.

B J and K are both metals.

C J and K are both non-metals.

D J is to the left of K in the Periodic Table.

Arrangement of the Periodic Table and trends Click for more variations

Answer D

3 Which statement about bromine is correct?

A Bromine has a greater density than chlorine.

B Bromine is a gas at room temperature and pressure.

C Bromine has a grey-black colour.

D Bromine is less reactive than iodine.

Group VII: the halogens Click for more variations

Answer A

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4 Some information about an element is shown.

melting point / °C	1555
boiling point / °C	2963
colour of oxide	brown
use of element	as a catalyst

What is the position of this element in the Periodic Table?

A Group I

B Group VII

C Group VIII

D transition elements

Transition elements Click for more variations

Answer D

5 Lithium and potassium are metals in Group I of the Periodic Table.

Lithium has a melting point of 181 °C and a density of 0.53 g / cm^3.

Which row describes the melting point and density of potassium?

	melting point in °C	density in g / cm^3
A	less than 181	less than 0.53
B	less than 181	greater than 0.53
C	greater than 181	less than 0.53
D	greater than 181	greater than 0.53

Group I: the alkali metals Click for more variations

Answer B

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6 The ions formed when element X and element Y react together are shown.

- Element X forms X^- ions.
- Element Y forms Y^{2+} ions.

Which row identifies the position of X and of Y in the Periodic Table?

	X	Y
A	Group I	Group VI
B	Group VII	Group II
C	Group VII	Group VI
D	Group I	Group II

Arrangement of the Periodic Table and trends Click for more variations

Answer B

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7 Table 1.1 gives the electronic configurations of some atoms and ions, **A** to **G**.

Table 1.1

	electronic configuration
A	2,5
B	2,8
C	2,8,2
D	2,8,4
E	2,8,5
F	2,8,6
G	2,8,18,7

Answer the following questions about **A** to **G**.
Each letter may be used once, more than once or not at all.

State which of the atoms or ions, **A** to **G**, could be:

(a) a noble gas atom

..... [1]

(b) an atom of an element in Group VI

..... [1]

(c) an atom with an atomic number of 14

..... [1]

(d) atoms from the same group

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

(e) a halogen atom

..... [1]

(f) an atom of an element which is a good conductor of electricity

..... [1]

(g) a stable ion of a Group V element

..... [1]

(h) an atom that forms an ion with a 2– charge.

..... [1]

[Total: 8]

Arrangement of the Periodic Table and trends Click for more variations

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7(a)	B	**1**
7(b)	F	**1**
7(c)	D	**1**
7(d)	A **AND** E	**1**
7(e)	G	**1**
7(f)	C	**1**
7(g)	B	**1**
7(h)	F	**1**

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8 The halogens are the elements in Group VII of the Periodic Table.

(a) Predict the physical state and colour of astatine at room temperature and pressure.

physical state .....

colour .....

[2]

(b) When chlorine reacts with aqueous potassium bromide a displacement reaction occurs.

(i) Describe the colour change of the solution.

from ..... to .....

[2]

(ii) Write a chemical equation for this reaction.

..... [2]

(c) Reactions occur when some aqueous solutions of halogens are added to aqueous solutions of halides.

Use the key to complete the table to show the results of adding halogens to halides.

key
✓ = reaction
✗ = no reaction

		halides		
		KCl(aq)	KBr(aq)	KI(aq)
halogens	Cl_2(aq)		✓	
	Br_2(aq)			
	I_2(aq)			

[2]

[Total: 8]

Group VII: the halogens Click for more variations

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8(a)	**M1** solid (1) **M2** black (1)	**2**
8(b)(i)	**M1** colourless (1) **M2** to brown / orange / yellow (1)	**2**
8(b)(ii)	Cl_2 +2KBr → 2KCl + Br_2 **OR** Cl_2 +2Br^- → 2Cl^- + Br_2 **M1** all formulae (1) **M2** equation balanced correctly (1)	**2**
8(c)	**M1** two ticks for Cl_2 / KI, Br_2 / KI (1) **M2** three crosses for Br_2 / KCl, I_2 / KCl and I_2 / KBr (1)	**2**

9 For each of the following unfamiliar elements predict one physical and one chemical property.

(a) caesium (Cs)

physical property .....

chemical property .....

..... [2]

(b) vanadium (V)

physical property .....

chemical property .....

..... [2]

(c) fluorine (F)

physical property .....

chemical property .....

..... [2]

[Total: 6]

Group I: the alkali metals Click for more variations

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9 In **(a)**, **(b)** and **(c)**, descriptions of chemical properties need not be detailed. If more than one answer is given in each section, mark the **first** one and ignore anything subsequent unless it contradicts what they have already written. No marks for reversing physical and chemical properties.

(a) properties should focus on a group 1 metal and not just metals in general

PHYSICAL soft / can be cut (with a knife) / low density / light / low melting point / (good) conductor (heat or electricity) / shiny (when freshly cut) / malleable / ductile / tarnishes [1]

CHEMICAL react with water (**not** steam) / (very) reactive / forms salts with halogens / react vigorously with acids (**ignore** concentration) / forms an alkaline or basic oxide / fixed oxidation state or oxidation number or valency of +1 / has one valency or outer shell electron **not** forms ionic compounds on its own. [1]

(b) properties should focus on a transition metal

PHYSICAL hard / high density / dense / high mp or bp / (good) conductor (heat or electricity) / strong / malleable / ductile / silver or grey or lustrous or shiny solid [1]

CHEMICAL more than one oxidation state or valency (**accept** many oxides) / forms coloured compounds or ions (**not** coloured on its own) / forms complex ions / behave as a catalyst / less reactive than group 1 [1]

(c) PHYSICAL colourless gas / yellow gas [1]
not diatomic molecules

CHEMICAL most reactive halogen / **very** reactive / forms **ionic** fluorides / bonds with metals / form **covalent** fluorides / bonds with non-metals / powerful oxidant / gains one electron (to be stable) / fixed oxidation state or valency of –1
allow decolourised when reacts with alkene) / forms F^- ions / forms acidic oxides / forms an acid when reacted with hydrogen / hydride is acidic [1]
not bleaching agent

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10 Dmitri Mendeleev published his first Periodic Table in 1869.
Part of this table is shown below.

			Ti = 50
			V = 51
			Cr = 52
			Mn = 55
			Fe = 56
			Co = 59
H = 1			Cu = 63.4
	Be = 9.4	Mg = 24	Zn = 65.2
	B = 11	A*l* = 27.4	?
	C = 12	Si = 28	?
	N = 14	P = 31	As = 75
	O = 16	S = 32	Se = 79.4
	F = 19	C*l* = 35.5	Br = 80
Li = 7	Na = 23	K = 39	Rb = 85.4

(a) (i) What differences are there between Mendeleev's table and the Periodic Table we use today?

.....

.....

.....

.....

..... [4]

(ii) State the names of any **two** elements in the table above which exist as diatomic molecules.

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

(b) Titanium is a transition element. Sodium is a metal in Group I of the Periodic Table.
State **three** differences in the physical properties of titanium and sodium.

1 .....

2 .....

3 .....

[3]

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(c) Titanium(IV) oxide reacts with a mixture of chlorine and carbon.
The products are titanium(IV) chloride, $TiCl_4$, and a gas which turns limewater milky.
Complete the symbol equation for this reaction.

$$TiO_2 + ...Cl_2 + C \rightarrow TiCl_4 + ...$$

[2]

(d) Titanium is extracted from titanium(IV) chloride by reduction with molten sodium in the presence of argon.
Suggest why this reaction is carried out in the presence of argon.

.....

..... [2]

[Total: 12]

Arrangement of the Periodic Table and trends Click for more variations

10 **(a)** **(i)** Any **four** suitable differences e.g.: [4]

- no noble gases / only 7 (standard) Groups ORA;
- hydrogen / H in same column as Li ORA;
- some elements missing / named element missing / empty spaces ORA
- groups are horizontal rather than vertical / reference to groups or periods being different ORA
- not ordered according to atomic number / no proton numbers
- Zn put in same group as Be and Mg ORA

(ii) any **two** from: [1]
fluorine, chlorine, bromine, oxygen , nitrogen , hydrogen

(b) any **three** from: [3]

- melting points / boiling points;
- density;
- catalytic activity;
- strength
- hardness
- electrical conductivity / heat conductivity
- malleability / ductility

(c) 2 (Cl_2); [1]
CO_2 (on right); [1]

(d) to prevent sodium reacting with air / to stop the Ti reacting with the air / to exclude air / to stop the hydrolysis of the titanium oxide / to exclude water (vapour); [1]

because argon is inert / unreactive / inactive / does not react; [1]

[Total: 12]

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