

Mark schemes

1	(i) 160	<i>ignore units</i>	1	
	(ii) 112	<i>ignore units</i>	1	
	(iii) 70	<i>do not carry forward errors</i>	1	[3]
3	(a) 2 2 multiples of $\frac{1}{2}$ allowed	<i>for 1 mark</i>	1	
	(b) (i) 2. 8. 1 and 2. 8. 7	<i>gains 3 marks</i>		
		1 mark for 2 electrons in each inner shell 1 mark for 8 electrons in each second shell 1 mark for 1 electron in sodium outer shell and 7 in chlorine outer shell	3	
	(ii) sodium atom loses; electron; chlorine atom gains; electron	<i>for 1 mark each</i>		
		inversion = 2 marks lose negative charge = 1 mark	4	
	(c) (i) KCl (accept 2KCl)	<i>for 1 mark</i>	1	
	(ii) both have one electron in outer shell/same number of electrons/ lose same number of electrons in compound formation/ both lose one electron	<i>for 1 mark</i>	1	

- (d) 0 amps;
the ions;
cannot move in the solid
solid Na chloride does not conduct

for 1 mark each

3

- (e) (i) water (H₂O)

for 1 mark

1

- (ii) (1) chlorine;
(2) hydrogen

for 1 mark

1

[15]

4

- (a) (i) 14 electrons =

gets 1 mark

2.8.4 =

gets 2 marks

2

- (ii) outer shell electrons

1

- (iii) same number of electrons in outer shell

1

- (b) (1) shiny
conducts electricity

- (2) oxide neutralises alkalis
covalent bonds

4

[8]

5

- (a) $40 + 12 + (3 \times 16) = 100$

each for 1 mark

2

(b) M_r of CaO = 56

for 1 mark

mass required = $60 \times 100/56$

for 2 marks

= 107.1

for 1 mark

4

(c) (i) calcium hydroxide

1

(ii) solid

1

[8]

6

(a) a substance which contains one type of atom
or a substance that cannot be **broken down**
into anything simpler

for 1 mark

1

(b) more than one element/more than one type of atom
combined/join together/bonded

for 1 mark each

2

[3]

7

(a) (i) same number of shells/2 full shells/3 shells/same number
of energy levels

any 1 for 1 mark

increasing number of electrons/different number of electrons/
number of electrons same as group
number

*(if electrons not specifically mentioned assume they are
referring to electrons)*

any 1 for 1 mark

2

- (ii) all have 7 electrons in outer shell/same number in outer shell/
each has one electron missing from outer shell
each can accept one electron

any 1 for 1 mark

number of shells/energy levels increases
increasing number of electrons

any 1 for 1 mark

2

- (b) (i) increases down group/decreases up
for 1 mark

1

- (ii) down group atoms get bigger/larger/have more shells/
more energy levels

for 1 mark

electrons further away from nucleus/more
shielding down group

for 1 mark

outer electron more easily lost/less
firmly held

for 1 mark

3

- (c) H^+ or has positive ions/one electron in outer shell/can lose
one electron/ H^+ ions discharged at negative electrode (max 2)
covalent bonds or compounds/forms diatomic mols. or example/
ability to form H^- ions/non-conductor/
low Mt.Pt or low B.P. (max 2)

(overall max 3)

3

[11]

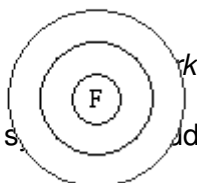
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- (a) 2, 8, 8, 1

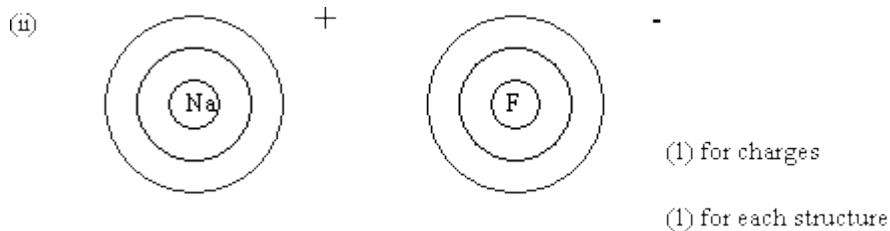
for 1 mark

1

- (b) ①



Ignore s... middle but structure must be drawn NOT 2,7



If covalent; can score mark for charges but not for diagram

Arrow showing electron transfer from metal atom to non-metal atom = 2 marks

If the ions are not identified then cannot score mark for charges

4

[5]

9

- (a) $4 \text{HCl} / 2\text{H}_2\text{O}$, allow multiples **or** fractions if whole equation balances

for 1 mark

1

- (b) germanium tetrachloride + water = germanium oxide + hydrochloric acid
If symbol equation given it must be correctly balanced
Allow germanium

for 1 mark

1

- (c) to purify the germanium oxide/remove impurities/give in pure product/to make pure germanium

for 1 mark

1

ensure complete reaction/reaction does not give a good yield

not to increase efficiency/to purify germanium

for 1 mark

1

- (d) (i) remove oxygen/addition of hydrogen/gain up electrons allow remove oxygen molecules

(ii) $\text{GeO}_2 = 73 + (2 \times 16) = 105$
mass of germanium = $525 \times (73/105)$
 $= 365 \text{ g}$

(or alternative methods)

apply consequential marking

for 1 mark each

3

- (e) (i) germanium is shiny/lustrous
 conducts a small amount of electricity *
 germanium oxide reacts with hydrochloric acid
 (and) metal oxides react with acid
 metal oxides are basic
 metal oxides are reduced by hydrogen
 Information must be taken from the passage.
 Apply the list principle if more than three answers are given.
 Assume the word 'it' refers to the metal.

any 3 for 1 mark each

3

- (ii) germanium is brittle
 germanium tetrachloride is a (volatile) liquid
 made of molecules
 germanium tetrachloride has covalent bonding or when two non-metals
 react they have covalent bonding
 GaCl_4^- /the salt of germanium undergoes hydrolysis/ reacts with water
 germanium is not a good conductor of electricity*
 * conductivity mark can only be given once

any 3 for 1 mark each

3

[13]

10

- (a) elements: aluminium, copper,
 compounds: pure water, sodium chloride,
 mixture: beer, milk

*2/3 correct gains 1 mark
 4/5 correct gains 2 marks
 all correct gains 3 marks*

3

- (b) metals: can be hammered into shape,
 good conductor of electricity, shiny
 non metals: brittle, dull, poor conductors of electricity

*2/3 correct gains 1 mark
 4/5 correct gains 2 marks
 all correct gains 3 marks*

3

[6]

- 11** (a) potassium, hydrogen,
carbon, oxygen,
chlorine or iodine
3 correct gains 1 mark
4 correct gains 2 marks
all correct gains 3 marks
(deduct 1 mark for each incorrect answer)
- 3
- (b) potassium (K)
for 1 mark
- 1
- [4]**
-
- 12** (a) potassium / K
for 1 mark
- 1
- (b) carbon dioxide / CO₂
for 1 mark
- 1
- (c) losing
electrons
gaining
electrons
for 1 mark each
- 4
- (d) (i) power supply, (not mains)
beaker containing solution,
(inert) electrodes and circuit
ammeter or bulb/
(or see bubbling etc. at electrodes written by drawing)
for 1 mark each
- 4

- (ii) reading on ammeter/bulb lights / (solution) conducts (electricity)
 bubbling / gas produced
 hydrogen produced
 chlorine / oxygen produced
 ions move
 to electrodes (must be linked to ions move)
 negative ions move to the positive electrode
and/or positive ions move to the negative electrode
 negative ions lose electrons
and/or positive ions gain electrons
any 3 for 1 mark each

3

[13]**13**

- (a) covalent/description of covalent
for 1 mark

1

- (b) forces/bonds between the molecules/particles (not atoms) are weak
for 1 mark each

2

- (c) non-flammable so it will not burn etc.
 extremely unreactive so it will not react with materials in the transformer,
 does not conduct electricity so it can insulate the transformer
 gas so it has freedom to move and insulate whole area
for 1 mark each

3

[6]**14**

electron
 nucleus
 neutron

*each for 1 mark***[3]****15**

56
 74

*each for 1 mark***[2]**

16

(a) light / caloric (heat)

for 1 mark

1

(b) (i) lime (calcium oxide) / magnesia (magnesium oxide)
barytes (barium sulphate) / argilla (aluminium oxide) /
silex (silicon dioxide)*for 1 mark*

1

(ii) Lavoisier / he could not break it down into anything simpler
by chemical methods of the time*for 1 mark*

1

[3]**17**

(a) plot correct (2 segments)

for 1 mark

1

(b) nitrogen + hydrogen \rightleftharpoons ammonia**or** N_2 H_2 NH_3 *all correct for 1 mark*

1

(c) largest area labelled nitrogen or shaded

for 1 mark

1

(d) (i) nitrogen

1

oxygen

hydrogen

1

*three correct for 2 marks**two correct for 1 mark*

(ii) potassium chloride

for 1 mark

1

(e) (i) $NH_4NO_3 = 14 + (4 \times 1) + 14 + (3 \times 16) = 80$ *for one mark*

1

(ii) ecf (error carried forward from part (i))

look for 28 / 80 for first mark

gains 1 mark

but 35% (% sign not needed)

special case of $(14 / 80 \times 100 = 17.5\%)$ gains 1 mark

gains 2 marks

2

[9]

18

(i) B or 2, 8, 1

for one mark

1

(ii) A or 2, 8

for one mark

1

[2]

19

B carbon monoxide

1

CO

accept carbon oxide
*do **not** credit carbon dioxide*
*do **not** credit if any superscripts **or***
subscripts used but accept C_1O_1 ,
accept OC
*do **not** credit if obviously lower case*

1

C water

1

H₂O

accept hydrogen oxide
do not accept hydrogen hydroxide
*do **not** credit if obviously lower case **or***
if 2 not subscript
*do **not** accept HOH*
accept OH₂

1

D ammonia

1



do not accept ammonium
*do **not** credit if obviously lower case,*
***or** if 3 not subscript*
*accept nitrogen hydride **or** hydrogen*
nitride
*do **not** accept hydrogen nitrate **or***
nitrite
allow H₃N

1

[6]**20**

(a) oxygen

Ignore any numbers
accept hydrogen oxide / steam

1

water

1

(b) catalyst

1

[3]**21**

(a) 9 protons /Proton Number 9

mass / atomic number is neutral

1

10 neutrons

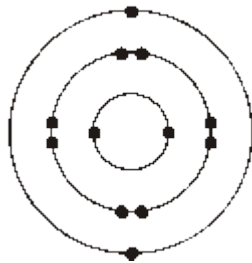
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electron arrangement 2,7 / 9 electrons

incorrect configurations neutral
if no points scored, allow 1 mark for nucleus surrounded by
*electrons **or** nucleus contains neutrons and protons*

1

(b)



Mark is for 2,8,2 arrangements.
accept electrons anywhere in correct orbit

1

[4]

22

(a) **A** – electron

1

B – nucleus

1

C – proton

1

D – neutron

1

(b) Group 1 / alkali metals

1

has one electron in outer shell

accept 3 protons / 3 electrons / atomic number 3
therefore lithium (so Group 1 / alkali metals)

1

(c) lithium

accept Li

1

[7]

23	(i) 4 and 1	<i>both answers must be correct</i>	1	
	(ii) 53.5	<i>if incorrect relative formula mass allow 1 mark for correct working accept e.c.f. from c(i) for 2 marks</i>	2	
				[3]
24	(a) proton + (1)	<i>both required</i>		
	neutron 1	<i>both required</i>		
	electron – (1)	<i>both required</i>	3	
	(b) 2.8.3	<i>accept words or diagram to this effect</i>	1	
	(c) (i) 24		1	
	(ii) 52		1	
	(d) any one of			
	• gains one or more electrons	<i>accept gains an electron</i>		
	• becomes an anion	<i>do not credit becomes an ion</i>		
	• becomes a <u>negative</u> ion		1	
	(e) sodium ions have a (single) positive charge <u>and</u> chloride ions have a (single) negative charge	<i>do not credit 'chlorine ions' but allow this error to be carried forward</i>	1	

ions with opposite charge are attracted (to each other)

or the positive ions and the negative ions are attracted (to each other)

or the sodium ions and the chloride ions are attracted (to each other)

1

(positive and negative) ions are arranged alternatively (in each direction **or** dimension)

or ions with the same charge are repelled (by each other) no mark for just ionic bonds

1

[10]**25**

(a)

both correct in each row

electron ...- (1)

allow negative

1

1 0

allow neutral or none

1

proton+ (1)

allow positive

1

(b) (i) protons...electrons

both correct in correct order

1

(ii) protons....neutrons

both correct in either order

1

(c) (i) sodium fluoride

do not credit sodium fluorine

1

NaF

must be correct in every detail

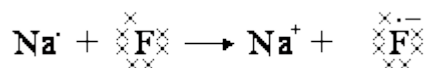
do not credit NAF and the like

1

(ii) ionic
accept ion (bonding)
*do not credit ionic **or** ion (bonding)* 1

(iii) electron transferred from sodium to fluorine
accept electron transferred from metal to non-metal
either positive sodium ion and negative fluoride ion
***or** correctly identified by the symbols Na⁺ and F⁻ accept 'positive sodium ion and negative fluoride ion'* 1

or attracted because have opposite charge(s)
or (atoms/ions) form an (ionic) lattice or (atoms/ions) form a crystal
e.g.



or both marks may be gained by a suitable dot and cross diagram 1

[10]

26

(i) two
or 2 1

(ii) magnesium **and** chloride
either order
***not** positive / negative*
do not credit 'chlorine'
*accept Mg⁺⁺ **and** Cl⁻*
do not credit just Mg and Cl⁻
*accept cation(s) **and** anion(s)* 1

(iii) 2 1

(iv) electrons
accept charges 1

(v) any **three** from

- (is a) giant structure/lattice structure
- crystalline / hard
accept just 'crystals(s)'
- high melting point / solid
- high boiling point
- conductor (of electricity) when dissolved **in** water
or conductor (of electricity) when ions are free to move
- conductor (of electricity) when molten
- soluble in water

3

[7]**27****NOTE**

In this question and throughout the Paper, if the name of a chemical is asked for, then the formula is acceptable only if it is correct in every detail. If the name is correct and the candidate has tried to be 'helpful' by giving, in addition, an incorrect version of the formula, then this is acceptable provided it does not lead to ambiguity.

(i) nitric (acid)

accept HNO_3

1

(ii) sulphuric (acid)

accept H_2SO_4

1

(iii) heat given out

or temperature rise

or energy given out

or steam

do not credit just 'use a thermometer'

do not credit just 'change in temperature'

1

(iv) neutralisation

accept neutralise
accept neutral
*accept formation of salt **or** water*
do not credit exothermic

1

[4]

28

(a) (i) rings of 2, 8 and 3 electrons

credit 2, 8, 3 pay particular attention to the outer shell in diagrams

1

(ii) rings of 2, 8 and 7 electrons

credit 2, 8, 7 pay particular attention to the outer shell in diagrams

1

(b) (i)

labels not required on atoms
charges need to be shown on ions
reference to outer shell is required otherwise a maximum of two marks

structure of atoms/ions marks

(ring of 2, 8, 1 for sodium) **or** the outer shell of sodium only contains 1 electron

*credit 2, 8, 1 **or** an ion 2, 8 **or** two circles and 1 electron in outer shell*

1

(ring of 2, 6 for oxygen) **or** outer shell only contains 6 electrons

*credit 2, 6 **or** an ion 2, 8 **or** two circles*

1

transfer of electrons mark

two sodiums needed to supply two outer electrons to oxygen to complete the (one oxygen's) outer shell

award maximum of two marks if a covalent structure is given
credit two rings of electrons for sodium showing outer electrons transferring to outer shell of one oxygen for three marks
do not accept diagrams showing overlapping rings for third mark

1

- (ii) loses an electron
credit atoms lose electrons or oxygen takes the electron ignore oil rig

1

[6]

29

- (a) (i) sodium..... positive **or +**
both required

1

chloride... negative **or -**
both required
do not credit chlorine

1

- (ii) ions not free (to move) in solid crystal / lattice
 ions are free to move when sodium chloride is molten

1

or ions are mobile
do not credit when ions are molten
allow 'particles' for ions (1) mark
do not credit electrons etc

1

- (iii) dissolved in water
or in aqueous solution
accept in solution
accept in water
or when a gas/ vapour **or** solid it will not

1

- (b) (i) 40

1

- (ii) (total) number of protons **and** neutrons (in the nucleus)

1

- (c) (i) $2\text{Ca} + \text{O}_2 \rightarrow 2\text{CaO}$

accept any $2n : n : 2n$ ratio
do not credit if any other change has been made

1

- (ii) any **two** from
 electron(s) is / are lost
 from the outer shell / orbit / ring
or from the shell furthest the nucleus
or from the 4th shell
- two / both (electrons are lost)
accept two electrons are lost for (2)marks
accept both electrons are lost from the
atom for (1) mark

2

[10]

30

- (a) (i) ammonia and hydrogen chloride
both required either order
accept formulae if correct in every detail
- (ii) ammonium chloride / NH_4Cl
do not credit ammonia chloride
- (iii) the fumes / gases / are poisonous / toxic
or ammonia and hydrogen chloride are
poisonous / toxic / lethal
accept just ammonia is poisonous / toxic
accept just hydrogen chloride is
poisonous / toxic
accept vapour is poisonous / toxic
do not credit just fumes are dangerous
or harmful

1

1

1

(iv) nitrogen
do not credit N/N₂ 1

hydrogen
do not credit H/H₂ 1

molecule
do not credit compound or mole 1

covalent
accept single / molecular 1

(b) (i) proton
neutron
electron
*either all three correct
or one or two correct
however do not credit a response
which is repeated* 2

(ii) protons and neutrons
both required in either order 1

[10]

31 (a) compound 1

(b) oxide 1

[2]

32 (a) same number/six electrons;
same number/six protons;
react in same way **not** same element or both carbon
any two for 1 mark each 2

(b) different number of neutrons
gains 1 mark

but

or

${}^{14}_6\text{C}$ has two more neutrons
gains 1 mark

different mass number

or

but two mass units bigger

gains 2 marks

${}^{14}_6\text{C}$ has 8 neutrons while
gains 2 marks

${}^{12}_6\text{C}$ has 6 neutrons

2

[4]

33

(a) 2.8.2. magnesium or 2.8.8.2. calcium
inner shell (2)
outer shell (2)
intermediate shell/s correct
element named to match structure

each for 1 mark

*(Structure correct for element name but not in group
2, award 2 marks)*

4

- (b) Similar hydrogen and/or an alkali/hydroxide produced
for 1 mark
- Reasons: chemical reaction involves loss of an electron
Na + Li have the same number of electrons in the outer
shell
(do not allow same group of p.table)
each for 1 mark
- Different rate of reaction faster for sodium*
for 1 mark
- Reason: outer electron more easily lost from the sodium atom
[* allow sodium hydroxide produced]
for 1 mark

5

[9]**34**

- (a) (i) $\square \text{H}_2 + \text{O}_2 \rightarrow \square \text{H}_2\text{O}$ *both circled correct
for 1 mark

1

- (ii) $\square \text{Al} + \square \text{O} \rightarrow \square \text{Al}_2\text{O}_3$ all circled correct
for 1 mark

1

- (b) *idea that:*
must end up with the same number of atoms as at the start
any 2 each
- otherwise matter is shown to be lost/gained
for 1 mark

won't show correct amount of each element/compound

2

[4]

- 35** (i) carbon dioxide (*allow* CO₂)
for 1 mark 1
- (ii) sodium nitrate (accept correct formula)
for 1 mark 1
- [2]**

- 36** (a) *reference to*
hydrogen (atoms))
nitrogen (atoms)) but **not** molecules
each for 1 mark

ratio of 1N to 3H **atoms**
for 1 further mark

or 1 nitrogen atom and 3 hydrogen atoms
(ignore any incorrect statements about nature of bonding)

3

- (b) *evidence of*
H = 1
N = 14
O = 16
gains 1 mark

but
H = 1
N = 14
O = 16 × 3 or 48
gains 2 marks

but 63
gains 3 marks

3

[6]

- 37** (a) (i) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ (*allow* $\text{H}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{H}_2\text{O}$)
both circled for 1 mark 1
- (ii) $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$
all circled for 1 mark 1

1

- (b) *idea that:*
 must end up with the same number of atoms
 otherwise matter is shown to be lost/gained
 doesn't show correct amount of each element/compared
each for 1 mark

2

- (c) *idea that:*
 oxygen has 2 electrons short in outer shell) in words or
 chlorine has 1 electron short in outer shell) indicated on diagram
 (shared pair/covalent bond with) hydrogen
 atom supplies **one** further electron*
 *(but do not allow hydrogen **gives away** electron or **ionic bond**)
for 1 mark each

3

[7]

38

- (a) (i) 27
 (ii) 13

each for 1 mark

2

- (b) each proton has a/1 positive charge and each electron has a/1 negative charge OR electrons and protons have (equal but) opposite charges there are equal numbers of protons and electrons in the atom/ so charges cancel or balance (each other)
each for 1 mark

2

- (c)

PARTICLE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluorine atom		10	
Fluoride atom	9		10

each for 1 mark

3

[7]

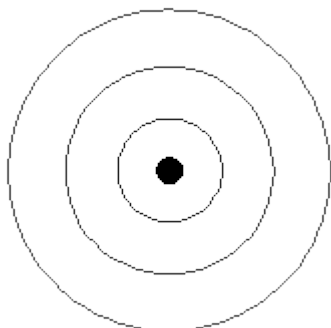
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contains oxygen atoms
 contains hydrogen atoms
 atoms are [chemically] bonded
 ratio of two hydrogen to two oxygen atoms

each for 1 mark

[4]**40**

(a)



each shell completed correctly
 [for written 2.8.2 award 1 mark]

for 1 mark each

3

(b) idea that

- chemical reactions of metals, involves losing electrons
for 1 mark
- these three elements have the same number of electrons in the outer shell/highest energy level
gains 1 mark

but

- these three elements all have two electrons in the outer shell/highest energy level
gains 2 marks

All form ions with a 2+ charge gains all 3 of these marks

- reactivity depends on how easily the electrons are lost
for 1 mark
- the further the electrons are from the nucleus/the higher the energy level they are in, the more shells the atom has*
then the more easily they are lost
for 1 mark
- in calcium the electrons are further from the nucleus than in magnesium than in beryllium
for 1 mark

or as you go down the group
(*not just "the more electrons"....)

6

[9]

41

- (a) Fe_2 [56 × 2] **or** 112
 O_3 [16 × 3] **or** 48

each gain 1 mark

but $M_r = 160$

gains 3 marks

3

- (b) $[\text{Fe}_2 \text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2 \text{O}_3]$

160 → 112 (NB Credit if unworked
(or value from (a)) (or value but should be totalled)
from (a)) from (a))

gains 1 mark

but

32 g. of $\text{Fe}_2 \text{O}_3 \rightarrow 32/160 \times 112$

gains 2 marks

but = 22.4

gains 3 marks

3

[6]

42

(a)

	Calcium	Phosphorus	Fluorine
No of protons		15	
No of neutrons			10
No of electrons	20		

for 1 mark each

3

(b) (i) gain of electron(s)

from (atoms) (of) calcium

for 1 mark

2

(ii) Ca^+ *gains 1 mark***but** superscript only Ca^{2+} / Ca^{++} *gains 2 marks*

2

(c) atoms

electrons

molecule(s)

not compound

each for 1 mark

3

(d) (i) *ideas that*

- ionic – strong forces between ions
 - molecular – weak forces between molecules
- each for 1 mark*

2

(ii) *ideas that*

- ionic – ions/charged particles are free to move
 - molecular -molecules do not carry a charge
- each for 1 mark*

2

[14]

- 43** *idea that*
- contains nitrogen atoms
 - contains hydrogen atoms
 - atoms are chemically bonded NOT linked/joined
 - ratio of one nitrogen to three hydrogen (atoms) formula of ammonia is NH_3
- for 1 mark each*
- [4]**

- 44** (a) lead chloride } *in any order*
potassium nitrate }
- for 1 mark each*
- 2

- (b) lead chloride is solid / a precipitate
potassium nitrate is aqueous / in solution / dissolves in water
NOT liquid
- for 1 mark each*
- 2

(Accept ratio of molecular KNO_3 : PbCl_2 is 2:1 for 2 marks)
(do not accept relative number of atoms in each compound)

One is a solid, one is a solution – worth 1 mark

[4]

- 45** (a) (i) neutron (*name only*)
- 2
- (ii) nucleus / protons and neutrons
each for 1 mark
(do not allow mass number)
- (b) Li (*correct cases of letters required*)
for 1 mark
- 1

[3]

46

- (a) positive / + / 2
gains 1 mark

but 2⁺ / ++ / +2
gains 2 marks

2

- (b) *Ideas that:* 2
Ca²⁺
Br [*Do not disqualify for "bromine" ions*]
Ions / They are in the ratio 1:2
any two for 1 mark each

2

[4]

47

- (a) A is sodium/Na⁺
B is argon/Ar⁺
each for 1 mark
(*case of letters must be correct)

2

- (b) (i) *ideas that*
- outer electron (in element C / 2.8.8.1 / potassium) is at a higher energy level / in a more outer shell/further away from nucleus / shielded by more full electron shells
 - electron is more easily lost/less strongly held / attracted
each for 1 mark

2

- (ii) *ideas that*
- (element B / 2.8.8 / argon) has an outer shell that is complete/has 8 electrons
 - no tendency to gain or lose electrons / has a stable configuration
 - (*not 'is stable' / 'in group O' / 'a noble gas'*)
each for 1 mark

2

[6]

48

- (a) Mg S O₄
 24 + 32 + 16 (×4) or 64 / evidence of all A's
gains 1 mark

but (M_r) = 120
gains 2 marks

2

- (b) evidence that 24(g) magnesium would produce 120(g) magnesium sulphate
gains 1 mark

or correct scaling by 1/6

but 20(g) magnesium sulphate
gains 2 marks
[credit error carried forward from (a) with full marks in (b)]

2

[4]

49

- (a) • vertical axis appropriately scaled
[i.e. using more than half the grid]
- all three points correctly plotted* (to < 1/2 a square)
 - reasonably straight line drawn through points (to < half a square)*
 [*credit both these marks for bars correctly drawn since discontinuous variable]
each • for 1 mark

x [If points incorrectly plotted credit 1 mark for the best fit straight line or curve but not point-to-point]

3

- (b) 44 (atomic units)
for 1 mark
(e.c.f. i.e. credit consistent with candidate's graph)

1

- (c) hydrocarbons / alkanes
for 1 mark

1

- (d) C_2H_6
 C_5H_{12}

each for 1 mark

[NB figures must be subscripted]

2

[7]**50**

- (a) electrons
neutrons
protons

for 1 mark each

3

- (b) mass number no. of neutrons
14 8

for 1 mark each

2

[5]

- 51** (a) lithium = Li
(ignore mass / atomic numbers)
fluorine = F *(do not allow if case is incorrect)*
for 1 mark each 2
- (b) (allow ● or O for electrons)
(allow any positions for the seven electrons added provided they are on the outer ring)
for 1 mark 1
- (c) (2,8)⁺ or (2,7)⁻
(brackets not required) gains 1 mark
- but** (2,8)⁻
gains 2 marks 2
- [5]**