AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.2.2.7

Properties of metals and alloys

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**54**
Available paper years	**2007–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.2.2.7 Properties of metals and alloys

Answer 01 · Mark scheme

June 2007 | CHY1A | Original Q4 | Legacy

Four	**A**	Aluminium	**2**
	B	Iron	**3**
	C	Mercury	**1**
	D	Potassium	**4**

Answer 02 · Mark scheme

June 2007 | CHY1A | Original Q6 | Legacy

The full source mark scheme begins on page 61. Follow original question 6 in that document.

Answer 03 · Mark scheme

June 2007 | CHY1F | Original Q6 | Legacy

The full source mark scheme begins on page 65. Follow original question 6 in that document.

4.2.2.7 Properties of metals and alloys

Answer 04 · Mark scheme

January 2008 | CHY1F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
(a)(i)	monomers		1
(a)(ii)	crude oil		1
(b)	any **three** from: • metal may not corrode away / remains • plastic remains / does not break down (decay) / not affected by microorganisms • should recycle / conserve resources / mend the kettle / burn (plastic) as a fuel • landfill sites are limited / filling up • water pollution	accept non-biodegradable accept it is a waste of materials / resources ignore harms wildlife / habitats **or** problems caused by burning the kettle	3
total			5

4.2.2.7 Properties of metals and alloys

Answer 04 · Mark scheme

January 2008 | CHY1F | Original Q4 | Legacy

CHY1F

4.2.2.7 Properties of metals and alloys

Answer 05 · Mark scheme January 2008 | CHY1F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
(a)	good (electrical) conductor	allow low reactivity / resistance to corrosion do **not** accept heat conductor	1
(b)	a mixture of metals	accept contains more than one type of metal	1
(c)(i)	any **one** from: • eyesore • destruction of habitats • pollution of water • dust pollution • noise • traffic pollution		1
(c)(ii)	acid rain	allow sulfur dioxide is a pollutant	1
(d)(i)	running out of copper (ores)		1
(d)(ii)	any **two** from: • any specific example of using less copper • reuse / recycle • use low-grade copper ores • use other metals / materials in place of copper	allow do **not** throw copper / brass away	2
total			7

4.2.2.7 Properties of metals and alloys

Answer 05 · Mark scheme January 2008 | CHY1F | Original Q6 | Legacy

CHY1F

Answer 06 · Mark scheme January 2008 | CHY2F | Original Q7 | Legacy

(c)	7		1
(d)(i)	steeper line from around the same starting point and left of the points levelling off at 99	allow crosses if they are fully correct for **1** mark accept short level line at 99 ± ½ square	1 1
(d)(ii)	any **three** from: • particles / molecules / atoms/ ions have more energy • move faster • collide <u>more</u> often **or** <u>more</u> chance of collisions **or** bump into each other <u>more</u> • collide with <u>more</u> force / energy **or** <u>more</u> particles have the activation energy **or** <u>more</u> collisions result in reaction **or** <u>more</u> collisions are successful	allow given / gain / get energy ignore move about more ignore vibrate more / faster ignore collide quicker / faster	3
total			8

4.2.2.7 Properties of metals and alloys

Answer 06 · Mark scheme

CHY2F

Question 7

question	answers	extra information	mark
(a)	any **one** from: • they are made of layers • atoms / ions / particles / layers (of atoms) can slide over each other	do **not** accept line / rows / lattice	1
(b)	any **one** from: • smaller / tiny **or** very small • correct size range 1 to 100 nanometres • a few hundred atoms in size	do **not** allow small alone if they state smaller and give a size outside range ignore size if it is less than 20,000	1
(c)	harder plus **one** from: • so does not wear as quickly / erode as quickly • less vulnerable to damage owtte • because they have a high surface area to volume ratio **or** stronger (1) plus **one** from: (1) • less likely to break / do not break • not as vulnerable to damage owtte • do not bend out of shape • because they have a high surface area to volume ratio	 ignore corrode harder to wear down = **1** mark accept withstand pressure harder and stronger alone gains **1** mark	1 1
total			4

4.2.2.7 Properties of metals and alloys

Answer 06 · Mark scheme

January 2008 | CHY2F | Original Q7 | Legacy

CHY2F

Answer 07 · Mark scheme

March 2008 | CHY1AP | Original Q7 | Legacy

Seven	**2**	**2**	**3**	**1**

4.2.2.7 Properties of metals and alloys

Answer 08 · Mark scheme

June 2008 | CHY1F | Original Q6 | Legacy

question	answers	extra information	mark
6(a)	(an alloy) that can return to its original shape (after being deformed / bent / twisted)	accept (on heating / cooling) it returns to its shape	1
6(b)	any **two** from: • brass / it is a mixture • zinc changes structure / disrupts patterns or layers • copper metal atoms / layers able to slide over each other	 accept brass / it is not pure accept zinc prevents atoms / layers sliding over each other	2
6(c)(i)	oxygen / O_2 / O		1
6(c)(ii)	lead remains (in furnace) because of its high boiling point zinc boils / evaporates (out of furnace) because of its low boiling point	 if neither mark awarded then allow **1** mark for different boiling points ignore references to melting points	1 1
Total			**6**

4.2.2.7 Properties of metals and alloys

Answer 08 · Mark scheme June 2008 | CHY1F | Original Q6 | Legacy

COMPONENT NUMBER: CHY1F

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: June 2008

Answer 09 · Mark scheme November 2008 | CHY1AP | Original Q4 | Legacy

Four	**A**	a mixture	**2**
	B	expensive to extract from its ore	**1**
	C	a good conductor	**4**
	D	hard-wearing	**3**

Answer 10 · Mark scheme November 2008 | CHY1AP | Original Q6 | Legacy

Six	**2**	**3**	**2**	**1**

Answer 11 · Mark scheme March 2009 | CHY1AP | Original Q4 | Legacy

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

Answer 12 · Mark scheme March 2009 | CHY1AP | Original Q9 | Legacy

Nine	**3**	**2**	**3**	**4**

Answer 13 · Mark scheme November 2009 | CHY1AP | Original Q2 | Legacy

Two	**A**	metal ore	**1**
	B	reactive metal	**4**
	C	transition metal	**3**
	D	metal alloy	**2**

4.2.2.7 Properties of metals and alloys

Answer 14 · Mark scheme

November 2009 | CHY1AP | Original Q6 | Legacy

Six	**2**	**4**	**2**	**4**

Answer 15 · Mark scheme

November 2009 | CHY1AP | Original Q9 | Legacy

Nine	**4**	**3**	**2**	**1**

4.2.2.7 Properties of metals and alloys

Answer 16 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	copper / Cu		1
1(a)(ii)	50(p)		1
1(a)(iii)	25		1
1(a)(iv)	tin		1
1(b)(i)	any **one** from: • high cost of copper • less copper available ***or*** (copper ores exhausted / **only** low-grade ores available) • high demand for copper • high percentage (%) of copper in the coin • inflation (of cost)	allow metal is expensive allow copper is non-renewable	1
1(b)(ii)	any **one** from: • stronger / harder • cost of copper **or** copper is more expensive to extract **or** steel is cheap • less copper available **or** (copper ores exhausted / **only** low-grade ores available) • high demand for copper • less copper is needed	ignore rust allow cheaper (to make)	1
Total			**6**

4.2.2.7 Properties of metals and alloys

Answer 16 · Mark scheme January 2010 | CHY1F | Original Q1 | Legacy

CHY1F

Answer 17 · Mark scheme January 2010 | CHY2F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1	the atoms are in layers the atoms can slide over each other		1 1
Total			**2**

Answer 18 · Mark scheme March 2010 | CHY1AP | Original Q2 | Legacy

Two	**A**	iron	**3**
	B	aluminium	**4**
	C	gold	**1**
	D	stainless steel	**2**

Answer 19 · Mark scheme March 2010 | CHY1AP | Original Q7 | Legacy

Seven	**4**	**4**	**4**	**2**

Answer 20 · Mark scheme March 2010 | CHY1AP | Original Q8 | Legacy

Eight	**2**	**3**	**2**	**2**

Answer 21 · Mark scheme June 2010 | CHY1AP | Original Q2 | Legacy

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

Answer 22 · Mark scheme June 2010 | CHY1AP | Original Q8 | Legacy

Eight	**2**	**1**	**1**	**2**

4.2.2.7 Properties of metals and alloys

Answer 23 · Mark scheme

June 2010 | CHY1F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	alloys		1
2(b)	bar drawn correctly up to 4%	ignore width of bar	1
2(c)	(contains) more carbon	ignore contains 4% carbon accept higher level responses related to structure / arrangement of atoms	1
2(d)(i)	73.8		1
2(d)(ii)	mild (steel)		1
2(d)(iii)	corrosion		1
Total			**6**

4.2.2.7 Properties of metals and alloys

Answer 23 · Mark scheme June 2010 | CHY1F | Original Q2 | Legacy

CHY1F

Answer 24 · Mark scheme November 2010 | CHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	Iron	**1**
	B	Aluminium	**2**
	C	Copper	**4**
	D	Calcium	**3**

4.2.2.7 Properties of metals and alloys

Answer 25 · Mark scheme

January 2011 | CHY1F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	conducts electricity		1
2(a)(ii)	mixture (of metals)	(it = alloy)	1
2(b)	any **two** from: • noise • dust • traffic • eyesore	ignore pollution without qualification allow dirt	2
Total			**4**

4.2.2.7 Properties of metals and alloys

Answer 25 · Mark scheme

January 2011 | CHY1F | Original Q2 | Legacy

CHY1F

Answer 26 · Mark scheme

March 2011 | CHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	Aluminium	**3**
	B	Calcium	**4**
	C	Copper	**2**
	D	Iron	**1**

Answer 27 · Mark scheme

June 2011 | CHY1AP | Original Q8 | Legacy

Eight	**3**	**2**	**4**	**1**

4.2.2.7 Properties of metals and alloys

Answer 28 · Mark scheme

June 2011 | CHY3F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	(copper) stops barnacles / seaweed (sticking)	it = copper accept lead doesn't stop barnacles / seaweed (sticking) ignore all other properties	1
6(a)(ii)	(Muntz Metal) is less expensive / cheaper / cheapest	it = Muntz Metal must be a comparison accept copper is more expensive ignore other properties	1
6(b)(i)	atomic absorption spec(troscopy) / spectrometry **or** mass spec(trometry) / spectroscopy	accept spectroscopy / spectrometry alone allow AAS / MS do **not** allow NMR spectroscopy **or** IR spectrometry **or** chromatography	1
6(b)(ii)	sensitive **or** detect (very) small amounts **or** only small sample needed	it = instrumental method allow (more) precise ignore accurate allow converse for chemical method ignore metal contains small amount / low concentration of iron	1
6(c)	any **two** from: • unreactive / not very reactive • strong / hard • malleable / easy to shape	transition elements (= they) allow does not corrode ignore reference to rust ignore tough / durable / hard wearing ignore ductile / density / melting point	2
Total			**6**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

4.2.2.7 Properties of metals and alloys

Answer 29 · Mark scheme

November 2011 | CHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	hard	**3**
	B	resistant to corrosion	**4**
	C	easily shaped	**2**
	D	brittle	**1**

4.2.2.7 Properties of metals and alloys

Answer 30 · Mark scheme

January 2012 | CH1FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	reduction		1
2(b)	carbon is less reactive than aluminium		1
2(c)	aluminium (ions) / they are positively charged so they are attracted **or** they move towards the negative electrode **OR** aluminium (ions) / they need to gain electrons (1) which come from the negative electrode (1)	they = aluminium ions ignore particle names accept aluminium (ions) / they are cations allow aluminium (ions) / they have an opposite charge if no other marks awarded allow 'opposites attract' for **1** mark	 1 1
2(d)	aluminium has a low density aluminium is resistant to corrosion		1 1
2(e)	**advantage** less carbon dioxide is produced **disadvantage** used aluminium cans have to be collected and transported		1 1
Total			**8**

4.2.2.7 Properties of metals and alloys

Answer 30 · Mark scheme

January 2012 | CH1FP | Original Q2 | Legacy

CH1FP

4.2.2.7 Properties of metals and alloys

Answer 31 · Mark scheme

June 2012 | CH1FP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	Aluminium has a low density Aluminium is resistant to corrosion		1 1
3(b)(i)	(an alloy) is a mixture of metals	accept (an alloy) can be a metal mixed with another metal **or** iron mixed with carbon / a non-metal	1
3(b)(ii)	pure metals are soft **or** alloys are hard	allow weak allow strong / keep their shape ignore rust / corrosion	1
3(c)(i)	crude oil		1
3(c)(ii)	hydrocarbons		1
3(c)(iii)	oxygen		1
3(d)(i)	hydrogen	allow H_2 or H	1
3(d)(ii)	only water is produced (from the fuel) **or** no carbon dioxide is produced (from the fuel)	 allow less carbon dioxide produced **or** less global warming allow carbon dioxide causes global warming	1
Total			**9**

4.2.2.7 Properties of metals and alloys

Answer 31 · Mark scheme

June 2012 | CH1FP | Original Q3 | Legacy

CH1FP

4.2.2.7 Properties of metals and alloys

Answer 32 · Mark scheme

June 2012 | CH2FP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	cryolite		1
4(a)(ii)	lower the melting point of the aluminium oxide		1
4(b)(i)	opposite charges **or** oxide ions are negative attract		1 1
4(b)(ii)	carbon		1
4(b)(iii)	reacts with oxygen **or** forms carbon dioxide	accept burns	1
4(c)	**Structure mark**: **either** Al (atoms) in layers / rows **or** alloy (atoms) not in layers / rows **Sliding mark**: **either** so (Al layers) can slide **or** so (alloy) layers cannot slide	 accept Al (atoms) all the same size allow Al (atoms) in lines accept different sizes of atoms in alloy allow alloy (atoms) not in lines	1 1
Total			**8**

4.2.2.7 Properties of metals and alloys

Answer 32 · Mark scheme

June 2012 | CH2FP | Original Q4 | Legacy

CH2FP

4.2.2.7 Properties of metals and alloys

Answer 33 · Mark scheme

January 2013 | CH1FP | Original Q4 | Legacy

question	answers	extra information	mark
4(a)(i)	Positive impact any **one** from: • provides employment **or** • improves local economy • improved transport - new roads are built, new rail links • after use the quarry could provide recreation facilities Negative impact any **one** from: • destruction of animal habitats • fewer plants and trees to absorb carbon dioxide • visual pollution **or** noise pollution **or** atmospheric / air pollution • more traffic • uses non-renewable resources	 allow dust pollution allow pollutants from burning diesel	1 1
4(a)(ii)	economical		1
4(b)	carbon / coke burns (in oxygen / air)	accept carbon / coke reacts with oxygen / air	1
4(c)(i)	iron oxide (reactant) carbon dioxide (product)	must be words	1 1
4(c)(ii)	reduction		1

4.2.2.7 Properties of metals and alloys

Answer 33 · Mark scheme

January 2013 | CH1FP | Original Q4 | Legacy

CH1FP

question	answers	extra information	mark
4(d)(i)	oxygen reacts with carbon **or** oxygen and carbon produce carbon dioxide / carbon monoxide carbon dioxide / carbon monoxide is a gas **or** the carbon is removed as a gas		1 1
4(d)(ii)	much harder		1
4(e)	Advantage: less carbon dioxide is produced Disadvantage: there are different types of steel which must be sorted		 1 1
Total			**12**

4.2.2.7 Properties of metals and alloys

Answer 33 · Mark scheme

January 2013 | CH1FP | Original Q4 | Legacy

CH1FP

4.2.2.7 Properties of metals and alloys

Answer 34 · Mark scheme

question	answers	extra information	mark
6(a)(i)	an alloy		1
6(a)(ii)	harder		1
6(b)(i)	162.5	correct answer with or without working gains **2** marks if no answer or incorrect answer then evidence of correct working [56 + (3x35.5)] gains **1** mark	2
6(b)(ii) **(view with 6bi)**	34.46	accept rounding from 34 - 34.5 correct answer with or without working gains **2** marks accept ecf from 6 (b)(i) correctly calculated for **2** marks if no answer or incorrect answer then evidence of 56 / 162.5 **or** 56 / answer to 6(b)(i) gains **1** mark	2
Total			**6**

4.2.2.7 Properties of metals and alloys

Answer 34 · Mark scheme

January 2013 | CH2FP | Original Q6 | Legacy

January 2013

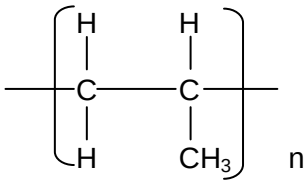
CH2FP

4.2.2.7 Properties of metals and alloys

Answer 35 · Mark scheme

June 2013 | CH1FP | Original Q5 | Legacy

Question 5

question	answers	extra information	Mark
5(a)(i)	ethene	allow C_2H_4	1
5(a)(ii)		accept line drawn from word 'Monomer' or from the monomer box to the correct 'Polymer' allow the correct 'Polymer' indicated by a tick, circled etc.	1
5(b)(i)	nickel	accept Ni	1
5(b)(ii)	75(%)		1
5(b)(iii)	(stainless steel) is hard /strong / durable (stainless steel) resistant to corrosion **or** unreactive	it = stainless steel accept (pure) iron is soft accept (pure) iron rusts / corrodes / reacts do **not** allow corrosive	1 1
5(c)	**Advantage**: Conserves resources of crude oil and ores **Disadvantage**: High cost of separating materials	do **not** allow more than one tick in the advantage column do **not** allow more than one tick in the disadvantage column	1 1
Total			**8**

4.2.2.7 Properties of metals and alloys

Answer 36 · Mark scheme

June 2013 | CH2FP | Original Q3 | Legacy

Question 3

question	answers	extra information	Mark
3(a)	(alloy) atoms / ions / particles not in layers	accept layers are distorted accept different (size) particles / atoms	1
	so, (alloy) layers / atoms / ions / particles can't slide	if no other mark awarded allow (an alloy) is a mixture of metals for **1** mark	1
3(b)	diamonds have a giant covalent structure		1
	diamonds have strong bonds between carbon atoms		1
3(c)(i)	a compound		1
3(c)(ii)	CH_4		1
3(c)(iii)	covalent		1
3(d)	methane has a low boiling point or boiling point less than 20°C		1
	because it has small molecules	accept it has forces between molecules accept weak forces between molecules for **2** marks	1
Total			9

4.2.2.7 Properties of metals and alloys

Answer 37 · Mark scheme

June 2013 | CH2FP | Original Q5 | Legacy

Question 5

question	answers	extra information	Mark
5(a)	giant lattices		1
5(b)(i)	heat / warm / increase the temperature	allow reduce pressure do not accept melt	1
5(b)(ii)	(polymer) chains cannot slide because they have cross-links	 if no other mark awarded allow polymers do not melt for **1** mark	1 1
5(c)(i)	separates (substances)		1
5(c)(ii)	any **two** from: • quick / rapid • accurate • can detect small quantities / sensitive	ignore reliable / precise / efficient ignore references to cost	2
Total			**7**

4.2.2.7 Properties of metals and alloys

Answer 38 · Mark scheme June 2014 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(a)	alloy		1	1 / 2.2.4d	A
2(b)	in mixture: *different sized / bigger atoms* *so there are no layers / rows / lines (to slide)*	accept converse	 1 1	1 / 2.2.4c / 2.1.1h	E
2(c)	any **two** from: • cost • toxicity • strength • *appearance of brace* • *unreactive **or** resistant to corrosion / saliva*	*ignore references to bend and mould* *allow rusting as alternative to corrosion*	2	3 / 2.2.4	E
2(d)	crosslinks	*allow lines / bonds between the rows / chains*	1	1 / 2.2.5b	E
Total			**6**		

4.2.2.7 Properties of metals and alloys

Answer 38 · Mark scheme

June 2014 | CH2FP | Original Q2 | Legacy



4.2.2.7 Properties of metals and alloys

Answer 39 · Mark scheme

June 2016 | CH1FP | Original Q3 | Legacy

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	because it is a good conductor of electricity.		1	AO1 1.3.3b
3(b)(i)	2.1 (%)		1	AO2 1.3.1c
3(b)(ii)	correct bar for calcium at 3.6 % correct bar for iron at 5.0 %	allow error of +/- 0.05% allow error of +/- 0.05%	1 1	AO2 1.3.1c
3(c)(i)	decomposition		1	AO1 1.1.3b; 1.2.1b/c
3(c)(ii)	carbon dioxide		1	AO1 1.2.1c
3(c)(iii)	carbon = 1 oxygen = 3	allow one allow three	1 1	AO2 1.1.3 a
3(c)(iv)	44 (g)	allow forty four	1	AO2 1.1.3 c
3(d)(i)	to make alloys for specific uses.		1	AO1 1.3.2a/b/c
3(d)(ii)	any **three** from: • to conserve resources of iron or iron ore • to avoid the need for quarrying/mining • to conserve energy resources or fossil fuels • to limit the amount of carbon dioxide produced or to reduce global warming • to reduce the amount of landfill	"it" = steel ignore cost and reuse and time and waste allow steel instead of iron or iron ore allow limited resource or non-renewable	3	AO1 1.3.1j
Total			**13**	

4.2.2.7 Properties of metals and alloys

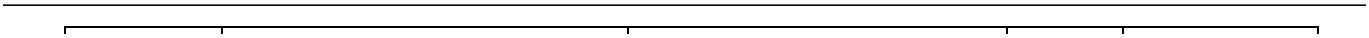
Answer 40 · Mark scheme June 2016 | CH2FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
1(a)(i)	7 / seven		1	AO1 2.1.1e
1(a)(ii)	1 Electron	do **not** accept -1	1 1	AO1 2.3.1b
1(a)(iii)	isotopes		1	AO1 2.3.1d
1(b)(i)	(sodium +) fluorine → sodium fluoride		1	AO2 2.1.1d,e
1(b)(ii)	compounds		1	AO1 2.1.1a
1(b)(iii)	mole		1	AO1 2.3.1g
1(b)(iv)	 sodium (atom) loses fluorine (atom) gains one electron ions formed	**max 3** if reference to incorrect particle / bonding allow sodium forms positive (ion) **or** fluorine forms negative (ion) allow form ionic bond allow to gain a full outer shell of electrons allow forms noble gas structure	 1 1 1 1	AO1 / AO2 2.1.1b,c,d,e,f
1(b)(v)	Dissolve in water High melting point		1 1	AO1 2.2.2a,b
Total			**13**	

4.2.2.7 Properties of metals and alloys

Answer 40 · Mark scheme

June 2016 | CH2FP | Original Q1 | Legacy



4.2.2.7 Properties of metals and alloys

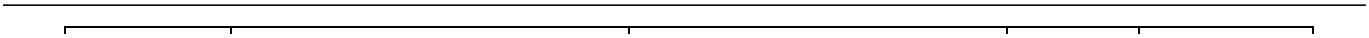
Answer 41 · Mark scheme June 2016 | CH2FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
3(a)	electricity	allow an electric current	1	AO1 2.7.1a; 2.2.2b
3(b)(i)	chlorine/Cl_2	do **not** accept chloride	1	AO2 2.7.1b
3(b)(ii)	(zinc ions are) positive and (opposite charges) attract	ignore to gain electrons	1 1	AO1/AO2 2.7.1c
3(b)(iii)	reduction		1	AO1 2.7.1e
3(c)(i)	in alloy: different sized atoms/particles **or** no layers/rows so cannot slide	accept converse accept layers distorted	 1 1	AO1/AO2 2.2.4b,c
3(c)(ii)	shape memory (alloys)	accept smart	1	AO1 2.2.4d
Total			**8**	

4.2.2.7 Properties of metals and alloys

Answer 41 · Mark scheme

June 2016 | CH2FP | Original Q3 | Legacy



4.2.2.7 Properties of metals and alloys

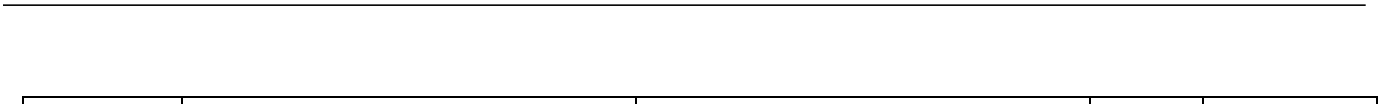
Answer 42 · Mark scheme June 2017 | CH1FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	hydrogen	allow H ignore numbers	1	AO2 1.1.2
2(b)	about 100		1	AO1 1.1.1a
2(c)	same number of electrons in the outer shell similar chemical reactions		1 1	AO1 1.1.2a
2(d)	noble transition	ignore inert	1 1	AO1 1.1.2b 1.3.3a
2(e)	ions molecules	in this order	1 1	AO2 1.1.3a
Total			8	

4.2.2.7 Properties of metals and alloys

Answer 42 · Mark scheme

June 2017 | CH1FP | Original Q2 | Legacy



4.2.2.7 Properties of metals and alloys

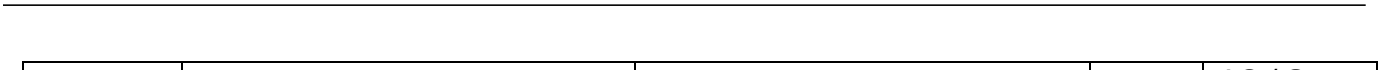
Answer 43 · Mark scheme June 2017 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	s		1	**AO2** 2.6.1a
2(a)(ii)	to speed up the reaction		1	**AO2** 2.6.1b
2(a)(iii)	tick (✓) by: 1		1	**AO1** 2.6.2d
2(a)(iv)	tick (✓) by: To make sure all the sulfuric acid has reacted		1	**AO1** 2.6.1b
2(b)(i)	funnel	accept filter funnel	1	**AO1** 2.6.1b
2(b)(ii)	heat / evaporate / boil	accept cool accept leave (to evaporate) do **not** accept heat until all water gone	1	**AO1** 2.6.1b
2(c)	tick (✓) by: The student left some copper sulfate crystals in the apparatus.		1	**AO3** 2.3.3d
2(d)(i)	white	accept grey	1	**AO1** 2.5.1d
2(d)(ii)	it goes blue	accept steam / water vapour ignore unspecified colour change	1	**AO1** 2.5.1d
2(e)(i)	polymers		1	**AO1** 2.2.5a
2(e)(ii)	as wealth decreases, ethene production decreases	accept converse	1	**AO2** 2.6; 3.7.12
2(e)(iii)	no relationship		1	**AO2** 2.6; 3.7.12
Total			**12**	

4.2.2.7 Properties of metals and alloys

Answer 43 · Mark scheme

June 2017 | CH2FP | Original Q2 | Legacy



Answer 44 · Mark scheme

June 2017 | CH2FP | Original Q6 | Legacy

The full source mark scheme begins on page 77. Follow original question 6 in that document.

Answer 45 · Mark scheme

June 2018 | 8462/1F | Original Q1

The full source mark scheme begins on page 91. Follow original question 1 in that document.

4.2.2.7 Properties of metals and alloys

Answer 46 · Mark scheme

June 2019 | 8462/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	B		1	AO2 4.1.1.1 4.1.1.2
03.2	D		1	AO2 4.1.1.1 4.1.1.2
03.3	E		1	AO2 4.1.1.1 4.1.1.2
03.4	chromatography – blue food colour from a mixture of food colours chromatography – copper from an alloy of copper and zinc crystallisation – copper sulfate from copper sulfate solution crystallisation – ethanol from a mixture of ethanol and water additional line from a box negates the mark for that box		1 1	AO2 4.1.1.2
03.5	(filter) funnel containing filter paper suitable vessel for collecting filtrate sand **and** water labelled in correct place		1 1 1	AO1 AO1 AO2 4.1.1.2
03.6	100 °C		1	AO2 4.1.1.2

4.2.2.7 Properties of metals and alloys

Answer 46 · Mark scheme

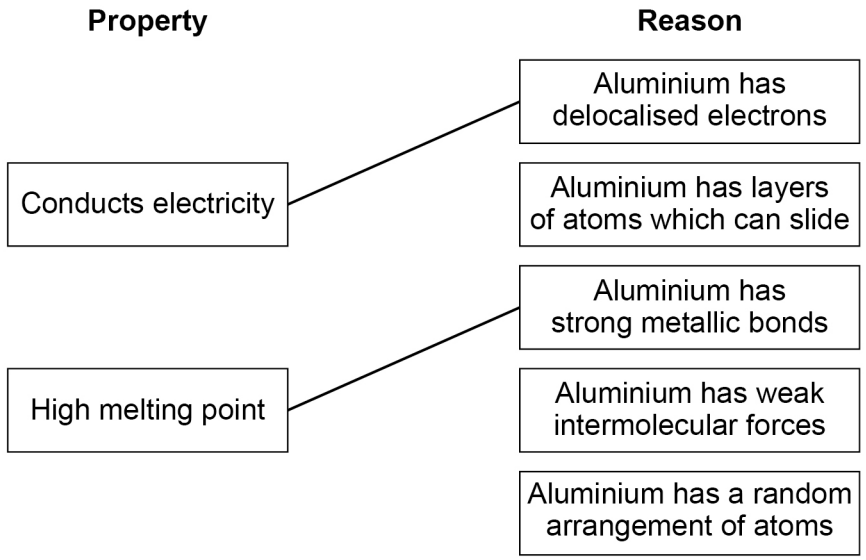
03.7	any **four** from: • solution is heated • water evaporates • the vapour cools in the condenser • the vapour condenses **or** the vapour turns to a liquid • (pure) water collects in the beaker	allow water boils / vaporises	4	AO1 4.1.1.2
Total			**13**	

4.2.2.7 Properties of metals and alloys

Answer 47 · Mark scheme

November 2020 | 8462/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	 additional line from a box on the left negates the mark from that box		1 1	AO1 4.2.1.5 4.2.2.7 4.2.2.8
05.2	a mixture of metals	allow a mixture of a metal with other elements	1	AO1 4.2.2.7
05.3	bauxite contains a variable percentage of aluminium	allow converse argument allow bauxite does not have a fixed proportion / percentage of aluminium	1	AO3 4.1.1.1
05.4	any **two** from: • danger of dam bursting • leakage of toxic substances from mud to environment • water pollution • damage to habitats • visual pollution • (dam) blocks light • reduces the value of houses	allow the lake (of mud) could overflow allow unpleasant smell	2	AO3 4.4.3.3

Question 5 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	10 / ten		1	AO2 4.1.1.1
05.6	to lower the melting point of the mixture		1	AO1 4.4.3.3
05.7	oxygen carbon	must be in this order	1 1	AO1 4.4.3.3
05.8	$\frac{25}{100}$ × 300 000 =75 000 (kg) = 7.5 ×10^4 (kg)	 allow correct conversion to standard form of an incorrectly calculated mass	1 1 1	AO2 4.4.3.3
Total			**13**	

Answer 48 · Mark scheme

November 2020 | 8462/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	tin		1	AO1 4.10.3.2
05.2	any **one** from: • ornaments • musical instruments • hinges / knobs / screws	allow any correct use of brass	1	AO1 4.10.3.2
05.3	(**A**) 12 (carat) (**B**) 3 (grams)		1 1	AO2 4.10.3.2
05.4	any **two** from: • (alloy of gold is) harder • (alloy of gold is) cheaper • aesthetic reasons	allow converse statements about pure gold	2	AO1 AO3 4.2.2.7 4.10.3.2
05.5	any **one** from: • does not corrode • does not react with water • is hard	allow will not rust	1	AO2 4.10.3.1 4.10.3.2
05.6	low carbon steel		1	AO3 4.10.3.2
Total			**8**	

4.2.2.7 Properties of metals and alloys

Answer 49 · Mark scheme

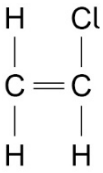
November 2021 | 8462/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	limestone sodium carbonate		1 1	AO1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	(advantage) stronger (reason) less easily damaged		1 1	AO3 AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(advantage) lower density (reason) lighter (to install)		1 1	AO3 AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4			1	AO2 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(add damp) litmus paper (litmus paper) is bleached **or** (litmus paper) turns white	ignore (litmus paper) turns red	1 1	AO1 4.8.2.4

Question 3 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	(polymers) last a long time (wood) renewable	ignore references to cost allow break down slowly allow trees can be replanted allow aesthetic reasons	1 1	AO3 AO1 4.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	(percentage of aluminium =) $\frac{5.94}{6.00} \times 100$ = 99 (%)		1 1	AO2 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	(alloy is) harder (than pure aluminium)	allow (alloy is) stronger (than pure aluminium) ignore references to cost	1	AO2 4.2.2.7 4.10.3.2

Total			14

4.2.2.7 Properties of metals and alloys

Answer 50 · Mark scheme

June 2023 | 8462/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(total atoms =) 30		1	AO2 4.2.2.7
	(percentage =) $\frac{6}{30} \times 100$	allow correct use of an incorrectly determined total number of atoms	1	
	= 20 (%)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	sizes	allow diameters do **not** accept shapes	1	AO1
	slide (over each other)	allow move over each other	1	AO3 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(as the percentage by mass of tin increases the) melting point (of solder) decreases		1	AO2 4.2.2.7
	to 183 °C	allow a value in the range 182–184 °C allow to 62% (tin)	1	
	then increases		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	232 °C		1	AO3 4.2.2.7

4.2.2.7 Properties of metals and alloys

Answer 50 · Mark scheme

June 2023 | 8462/1F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	the atoms gain energy and their arrangement becomes less ordered		1	AO1 4.2.2.1

Total Question 4	**10**

4.2.2.7 Properties of metals and alloys

Answer 51 · Mark scheme

June 2023 | 8462/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	carbon		1	AO1 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	chromium nickel		1 1	AO1 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	hard resistant to corrosion	in either order	1 1	AO1 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	(percentage of titanium = 100 – 3.0 – 2.5) = 94.5 (%) (mass =) $\frac{94.5}{100} \times 5.0$ = 4.725 (kg) **alternative approach:** (mass of Al + V = $\frac{5.5}{100} \times 5.0$ =) 0.275 (kg) (1) (mass of titanium =) 5 – 0.275 (1) = 4.725 (kg) (1)	 allow correct use of incorrectly determined percentage of titanium allow 4.7 / 4.73 (kg) allow correct use of incorrectly determined mass of Al and V allow 4.7 / 4.73 (kg)	1 1 1	AO2 4.10.3.2

4.2.2.7 Properties of metals and alloys

Answer 51 · Mark scheme

June 2023 | 8462/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	(both are) strong	allow (both contain) more aluminium	1	AO3 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	tin is toxic	allow tin reacts in the body	1	AO3 4.10.3.2

Total Question 7	10

4.2.2.7 Properties of metals and alloys

Answer 52 · Mark scheme

June 2024 | 8462/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	alloy reinforcement		1 1	AO1 AO2 4.10.3.2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	burning (of methane) releases carbon dioxide decomposition (of limestone) releases carbon dioxide	allow burning methane ignore methane is a greenhouse gas allow decomposition of limestone	1 1	AO2 4.9.2.2 4.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	hydrochloric acid limewater		1 1	AO1 4.8.3.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	(pre-stressed concrete) can bear the weight of (heavy) traffic (because pre-stressed concrete is) stronger	allow converse for plain concrete allow (pre-stressed concrete) bridge is less likely to collapse do **not** accept (because pre-stressed concrete is) more dense	1 1	AO3 4.10.3.3

4.2.2.7 Properties of metals and alloys

Answer 52 · Mark scheme

June 2024 | 8462/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	any **two** from: (plain concrete slabs) • are cheaper • will be lighter (to transport / lay) • do not need to carry vehicles	allow converse for pre-stressed concrete	2	AO3 4.10.3.3

Total Question 7	10

4.2.2.7 Properties of metals and alloys

Answer 53 · Mark scheme

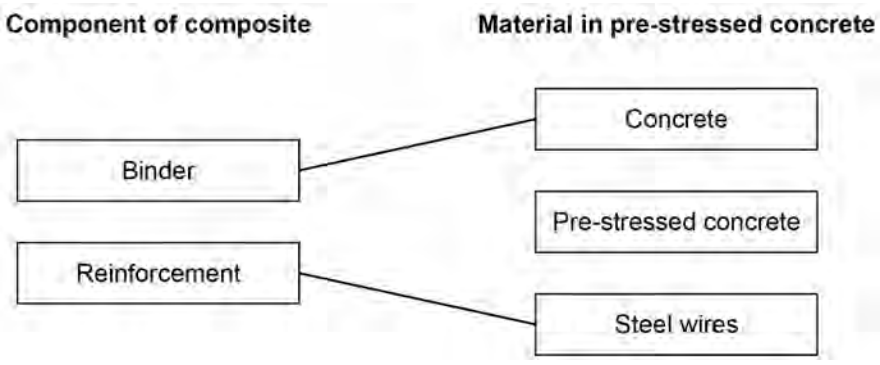
June 2025 | 8462/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(the sign) ⇌	allow a description of the reversible sign	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	endothermic	allow (thermal) decomposition	1	AO1 4.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(energy released =) $\frac{4}{20} \times 23$ = 4.6 (kJ)		1 1	AO2 4.6.2.2

Question	Answers	Mark	AO / Spec. Ref.
03.4	 do **not** accept more than one line from a box on the left	1 1	AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	iron	allow Fe	1	AO1 4.10.3.2

4.2.2.7 Properties of metals and alloys

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	clay		1	AO1 4.10.3.3

Total Question 3	8

Answer 54 · Mark scheme

June 2025 | 8462/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(mass =) $\frac{75}{100}$ x 4 = 3 (g)		1 1	AO2 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	3 : 1		1	AO2 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	copper silver		1 1	AO1 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	(18 carat gold) contains different sized atoms (so the) layers are distorted (so the) layers (of atoms) slide less easily	 allow (so the) atoms cannot slide over each other	1 1 1	AO2 4.2.2.7 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	any **one** from: • iron rusts • aesthetic reasons		1	AO2 4.10.3.1 4.10.3.2

Total Question 7	9

Version1.2:15/08/07

ASSESSMENT and QUALIFICATIONS ALLIANCE

GCSE

Science A 4461

Chemistry 4421

CHY1A F & H

Mark Scheme

2007 examination - June series

4.2.2.7 Properties of metals and alloys

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Dr Michael Cresswell Director General

4.2.2.7 Properties of metals and alloys

CHY1A (Products from Rocks)

Foundation Tier

Question	Key		
One	**A**	atom	**3**
	B	compound	**2**
	C	element	**4**
	D	symbol	**1**
Two	**A**	gold (Au)	**3**
	B	lithium (Li)	**4**
	C	calcium (Ca)	**1**
	D	sulfur (S)	**2**
Three	**A**	a bond	**3**
	B	an electron	**2**
	C	a molecule	**4**
	D	a nucleus	**1**
Four	**A**	Aluminium	**2**
	B	Iron	**3**
	C	Mercury	**1**
	D	Potassium	**4**
Five	**A**	one	**2**
	B	four	**3**
	C	five	**1**
	D	seven	**4**
Six	**A**	hard	**3**
	B	resistant to corrosion	**4**
	C	easily shaped	**2**
	D	brittle	**1**

	A	B	C	D
Seven	**2**	**4**	**3**	**2**
Eight	**1**	**2**	**2**	**3**
Nine	**1**	**2**	**4**	**3**

4.2.2.7 Properties of metals and alloys

CHY1A (Products from Rocks)

Higher Tier

Question	Key		
One	**A**	hard	**3**
	B	resistant to corrosion	**4**
	C	easily shaped	**2**
	D	brittle	**1**
Two	**A**	an alloy	**4**
	B	an element	**1**
	C	a hydrocarbon	**2**
	D	a mixture of compounds	**3**

	A	B	C	D
Three	**1**	**2**	**2**	**3**
Four	**1**	**2**	**4**	**3**
Five	**3**	**2**	**1**	**1**
Six	**4**	**4**	**3**	**3**
Seven	**3**	**2**	**3**	**3**
Eight	**1**	**3**	**2**	**3**
Nine	**2**	**3**	**2**	**3**

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1F Unit Chemistry 1

Mark Scheme

2007 examination - June series

4.2.2.7 Properties of metals and alloys

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Dr Michael Cresswell, Director General.

4.2.2.7 Properties of metals and alloys

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.2.2.7 Properties of metals and alloys

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.2.2.7 Properties of metals and alloys

CHY1F Question 1

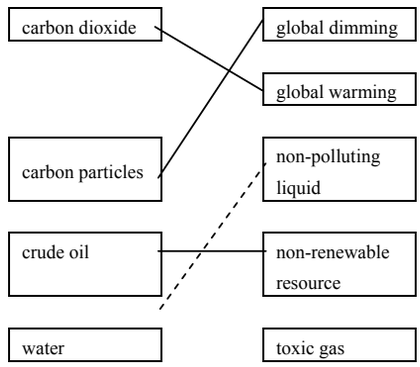
	answers	extra information	mark
(a)	low density unreactive		1 1
(b)	a polymer		1
(c)	any **one** from: • not broken down by (microorganisms) • does not decay (naturally)	ignore cannot recycle / degrade / disintegrate	1
total			4

CHY1F Question 2

	answers	extra information	mark
(a)(i)	additive		1
(b)	any **three** from: • colour 1 is made up of only one colour / dye • colour 2 is made up of only one colour / dye • colour 3 is made up of two colours / dyes **or** more colours (than colours 1 and 2) • colours 1, 2 and 3 are all different • colour 1 is less dark than colour 2	accept colour 3 is a mixture of colours 1 and 2 for **3** marks accept E-number or additive instead of colour ignore comments about height / level	3
total			4

4.2.2.7 Properties of metals and alloys

CHY1F Question 3

	answers	extra information	mark
(a)	hydrogen	ignore formulae	1
(b)	any **two** from: • different sized molecules / more or less (carbon) atoms (in molecules) • fuels have <u>different</u> boiling points • fuels condense at <u>different</u> temperatures	ignore different densities	2
(c)		all three correct = **3** marks two correct = **2** marks one correct = **1** mark	3
total			6

4.2.2.7 Properties of metals and alloys

CHY1F Question 4

	answers	extra information	mark
(a)(i)	any **one** from: • iron ore is a limited resource / non-renewable • iron is in high demand • provide jobs • economic advantage		1
(ii)	any **two** from: • would damage (wildlife) habitats / countryside / greenfield sites • extra traffic • visual (pollution) / eyesore • noise (pollution) / sound (pollution) • dust (pollution) • river (pollution) • carbon dioxide (from traffic) / adds to greenhouse effect / global warming • damage roads / buildings by <u>vibrations</u> / <u>shockwaves</u>		2
(b)(i)	carbon monoxide / carbon	accept formulae CO / C	1
(ii)	atoms are all the same (size) / type	accept (particles) are all the same (size) / type for one mark	1 1

Continued on next page

4.2.2.7 Properties of metals and alloys

Question 4 continued

	answers	extra information	mark
(iii)	any **two** from: • impurities / carbon / different (sized) atoms **or** elements **or** metals • changes the structure / disrupts the pattern or layers • prevents layers sliding over each other • it is an alloy		2
total			8

4.2.2.7 Properties of metals and alloys

CHY1F Question 5

	answers	extra information	mark
(a)	core	ignore outer or inner	1
	mantle		1
(b)(i)	carbon dioxide	accept formula CO_2	1
	oxygen	accept formulae O_2 / O	1
(ii)	4%		1
(iii)	carbon dioxide has <u>decreased</u> / from 95% to 0%		1
	oxygen has <u>increased</u> / from 0% to 21%		1
	any **one** from: (carbon dioxide decrease) • carbon dioxide used during photosynthesis / by plants • carbon dioxide dissolves in oceans • carbon dioxide is locked up in rocks / carbonates / fossil fuels (oxygen increase) • oxygen released during photosynthesis / by plants		1
total			8

4.2.2.7 Properties of metals and alloys

CHY1F Question 6

	answers	extra information	mark
(a)	any **two** from: • nitrogen • carbon dioxide • water (vapour) / steam	 accept formulae N / N_2 accept formula CO_2 ignore CO accept formula H_2O	2
(b)	any **three** from: <u>limestone</u> • abundant / local • natural material **or** no 'processing' needed • relatively easy to cut • appearance better <u>concrete</u> • <u>raw materials</u> are abundant • can be reinforced (by steel rods) / strong(er) / supported (by steel rods) • concrete mixture can be poured / moulded / constructed on site • less reactive with acid rain / weathering / erosion	no mark for 'limestone' or 'concrete' on first line – mark advantages only ignore ideas of speed of production or easier to use accept 'can build higher' ignore density / extraction / quarrying / pollution / cost	3
total			5

4.2.2.7 Properties of metals and alloys

CHY1F Question 7

	answers	extra information	mark
(a)(i)	$Cu_2S + 2O_2 \rightarrow 2CuO + SO_2$	accept fractions and multiples	1
(ii)	any **two** from: • sulfur dioxide • causes acid rain • consequence of acid rain eg kills fish / plants	 accept sulphur dioxide / sulphur oxide / SO_2 ignore other comments eg global warming / ozone / global dimming / greenhouse effect	2
(b)	any **two** from: • heat (copper oxide with carbon) • oxygen is removed by carbon **or** carbon monoxide / carbon dioxide is produced **or** carbon displaces copper • because carbon is more reactive than copper	 accept copper (oxide) loses oxygen **or** carbon gains oxygen accept carbon oxide accept a correct word or balanced symbol equation allow a correct comparison of reactivity	2
(c)(i)	electrolysis	accept electroplating	1
(ii)	(electrical) wiring / appliances / coins / pipes / cladding for buildings / jewellery / making alloys **or** named alloys		1

Continued on next page

4.2.2.7 Properties of metals and alloys

Question 7 continued

	answers	extra information	mark
(d)	any **three** explanations from: <u>for recycling</u> • less acid rain (pollution) • copper reserves last longer / conserved **or** do not run out • energy for extraction (saved) **or** less energy required • less mining / quarrying • less waste (copper) / electrical appliances dumped **or** less landfill <u>against recycling</u> • collection problems • transport problems • difficult to separate copper from appliances • energy used to melt the collected copper	ignore electrolysis / pollution ignore ideas about less machinery / plant ignore idea of cost	3
total			10

4.2.2.7 Properties of metals and alloys

GCSE

Additional Science / Chemistry

CH2FP
Final Mark scheme

4408 / 4402
June 2017

Version/Stage: v1.0

4.2.2.7 Properties of metals and alloys

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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4.2.2.7 Properties of metals and alloys

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.
At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.
In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Different terms in the mark scheme are shown by a / ; eg allow smooth/free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols/formulae

If a student writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.
Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation 'ecf' in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept/allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore/Insufficient/Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain a marking point. Any further correct amplification could gain the marking point.
Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4 Quality of Written Communication and levels marking

In Question 6 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail.
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information.
- Clear understanding.
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given.
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised.
- Detailed understanding, supported by relevant evidence and examples.
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.2.2.7 Properties of metals and alloys

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1 (a)(i)	the ink would run / smudge / smear	accept converse	1	**AO1** 2.3.2b
1 (a)(ii)	below		1	**AO1** 2.3.2b
1 (a)(iii)	any **two** from: • contains red • does not contain blue • contains two other colours • contains three colours in total	do **not** accept contains red and blue	2	**AO3** 2.3.2b
1(b)(i)	separated		1	**AO1** 2.3.2c
1(b)(ii)	6/six		1	**AO2** 2.3.2c
1(b)(iii)	any **one** from: • accurate • sensitive • rapid / fast • small sample.	do **not** accept more precise do **not** accept more reliable	1	**AO1** 2.3.2a
Total			**7**	

4.2.2.7 Properties of metals and alloys

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	s		1	AO2 2.6.1a
2(a)(ii)	to speed up the reaction		1	AO2 2.6.1b
2(a)(iii)	tick (✓) by: 1		1	AO1 2.6.2d
2(a)(iv)	tick (✓) by: To make sure all the sulfuric acid has reacted		1	AO1 2.6.1b
2(b)(i)	funnel	accept filter funnel	1	AO1 2.6.1b
2(b)(ii)	heat / evaporate / boil	accept cool accept leave (to evaporate) do **not** accept heat until all water gone	1	AO1 2.6.1b
2(c)	tick (✓) by: The student left some copper sulfate crystals in the apparatus.		1	AO3 2.3.3d
2(d)(i)	white	accept grey	1	AO1 2.5.1d
2(d)(ii)	it goes blue	accept steam / water vapour ignore unspecified colour change	1	AO1 2.5.1d
2(e)(i)	polymers		1	AO1 2.2.5a
2(e)(ii)	as wealth decreases, ethene production decreases	accept converse	1	AO2 2.6; 3.7.12
2(e)(iii)	no relationship		1	AO2 2.6; 3.7.12
Total			12	

4.2.2.7 Properties of metals and alloys

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	tick (✓) by: covalent		1	AO1 2.1.1g
3(a)(ii)	ticks (✓) by: oxygen consists of small molecules oxygen has a low boiling point		1 1	AO1 2.1.1g
3(b)(i)	magnesium (atom) loses (electrons) oxygen (atom) gains (electrons) two (electrons) ions formed	max 3 if reference to incorrect particle or incorrect bonding accept ionic bonding or full outer shells/noble gas structure is formed allow magnesium forms positive (ion) **or** oxygen forms negative (ion)	1 1 1 1	AO1 AO2 2.1.1a,b,c, d,e,f
3(b)(ii)	ticks (✓) by: nanoparticles contain a few hundred atoms nanoparticles have a high surface area to volume ratio		1 1	AO1 2.2.6a
3(c)	giant covalent		1	AO1 2.2.3a
Total			10	

4.2.2.7 Properties of metals and alloys

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	58.5		1	**AO2** 2.5.1b
4(b)	water		1	**AO2** 2.3.3a
4(c)(i)	prevents loss of thermal energy	allow prevents heat loss	1	**AO1** 2.6.1
4(c)(ii)	13/thirteen		1	**AO3** 2.5.1
4(c)(iii)	temperature changes/results are all similar	accept no anomalous results allow they are all similar do **not** accept temperature	1	**AO2** 2.5.1
4(c)(iv)	exothermic	allow giving out energy	1	**AO3** 2.5.1
4(d)(i)	ions move	allow they move ignore free ions do not accept movement of electrons	1	**AO1** 2.7.1a 2.2.2b
4(d)(ii)	(chloride ions are) negative	accept opposites attract do **not** accept chlorine is negative	1	**AO1** 2.7.1c
4(d)(iii)	Tick (✓) by: soap		1	**AO1** 2.7.1i
4(d)(iv)	1 bonding pair of electrons 6 unbonded electrons on Cl	accept dot, cross, e or – or any combination	1 1	**AO2** 2.1

4.2.2.7 Properties of metals and alloys

4(d)(v)	Tick (✓) by: $\frac{1}{36.5}$ x 100		1	**AO2** 2.3.3a
Total			**12**	

4.2.2.7 Properties of metals and alloys

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	a smooth curve through or close to all points except (30,12)		1	**AO2** 2.4
5(a)(ii)	correct reading from the curve in 1(a)(i) (cm^3)	allow a tolerance of +/- 0.5 cm^3	1	**AO2** 2.4
5(a)(iii)	45-50 (seconds)		1	**AO3** 2.4
5(a)(iv)	line becomes less steep because gas is produced more slowly	ignore line levels out or plateaus allow examples with figures, eg 12 cm^3 gas from 0 to 20s but 1.5 cm^3 gas in last 20s ignore reaction has stopped or no more gas produced	1 1	**AO3** 2.4
5(a)(v)	0.6 (cm^3 per second)	allow 0.55 to 0.65	1	**AO2** 2.4
5(b)(i)	 temperature volume (of hydrogen peroxide)	concentration of hydrogen peroxide = max **1** ignore amount (of hydrogen peroxide)	 1 1	**AO3** 2.4
5(b)(ii)	 rate increases because more particles (in the same volume) so frequency of collisions increases	incorrect reference to energy = max **2** accept particles closer together allow greater chance of collisions ignore more collisions	 1 1 1	**AO1** 2.4.1e

4.2.2.7 Properties of metals and alloys

5(c)	(increasing the amount of catalyst) increases rate same final volume of gas	accept steeper graph or graph levels off earlier	1 1	**AO2** 2.4.1g
Total			**13**	

4.2.2.7 Properties of metals and alloys

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>6</td><td></td><td></td><td>6</td><td rowspan="6">AO1
2.1.1h
2.2.4b,c
2.2.5a,b</td></tr>
<tr><td colspan="4">Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a ‘best-fit’ approach to the marking.</td></tr>
<tr><td>0 marks</td><td>Level 1 (1–2 marks)</td><td>Level 2 (3–4 marks)</td><td>Level 3 (5–6 marks)</td></tr>
<tr><td>no relevant information given</td><td>a statement about the structure or a property of a metal
or
a statement about the structure or a property of a polymer</td><td>a statement about the structure or a property of a metal
and
a statement about the structure or a property of a polymer</td><td>a statement about the structure or a property of a metal
and
a statement about the structure or a property of a polymer
and
at least one statement linking structure and property</td></tr>
<tr><td colspan="4">Statements shown as HT only are credited on both FT and HT.
However, HT only means that these statements are not expected in a FT answer.</td></tr>
<tr><td colspan="4">Examples of chemistry points made in response
Metal:
Properties
shiny
hardness
(tensile) strength
melting point/boiling point
density
malleable/flexible
ductile
conduct electricity or thermal energy</td></tr>
</table>

MARK SCHEME – GCSE ADDITIONAL SCIENCE / CHEMISTRY – CH2FP – JUNE 2017

Structure

- metals contain atoms /((positive) ions HT only)
- (the atoms/(positive) ions/particles are) closely packed / in a regular pattern / in a giant structure/in layers / in a lattice
- strong bonds/(electrostatic attractions HT only)
- (metal has delocalised electrons HT only)

Polymer:

Properties

- flexible
- melting/boiling point
- density
- can be shaped/moulded
- poor conductor of electricity or thermal energy

Structure

- polymer consists of chains
- polymer chains may be tangled
- polymer has no cross links.
- (polymer has weak intermolecular forces HT only)

Level 3:

Examples of linked statements:

- metal can be bent and shaped because the layers can slide
- some metals are soft because layers can slide
- some metals are hard because they have strong bonds and/ or (the atoms/(positive) ions/particles) are closely packed / in a regular pattern / in a giant structure / in a lattice
- metal has high melting/boiling point because they have strong bonds and/ or (the atoms/(positive) ions/particles) are closely packed / in a regular pattern / in a giant structure / in a lattice
- metal is strong because of strong bonds
- some metals are dense because the atoms are closely packed
- (metal can conduct thermal energy and electricity because metal has delocalised electrons HT only)
- thermosoftening polymer melts when heated because it has no cross-links (or has weak intermolecular forces HT only)
- thermosoftening polymer is flexible because the chains can move over each other

Total			**6**

4.2.2.7 Properties of metals and alloys

AQA

GCSE
CHEMISTRY

8462/1F - PAPER 1 FOUNDATION TIER

Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

4.2.2.7 Properties of metals and alloys

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MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do not accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

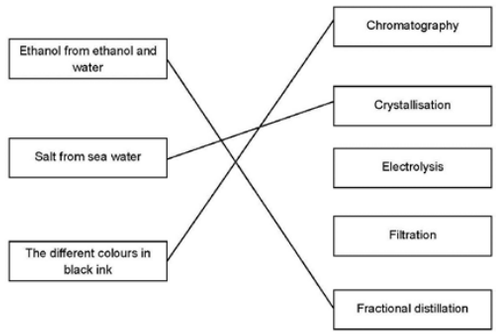
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1 1 1	AO1 4.1.1.2
01.2	include a (filter) funnel	allow funnel drawn on the diagram ignore clamp stand	1	AO3 4.1.1.2
01.3	evaporate condense	must be this order	1 1	AO1 4.1.1.2
01.4	$\frac{2}{20} \times 100$ = 10 (%)	an answer of 10 (%) scores **2** marks an answer of 11.1(%) **or** 90 (%) scores **1** mark	1 1	AO2 4.2.2.7
01.5	an alloy		1	AO1 4.2.2.7
01.6	the layers in the mixture are distorted		1	AO1 4.2.2.7

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	8000 nm^3		1	AO2 4.2.4.1
Total			**11**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	7		1	AO1 4.1.2.6
02.2	small molecule		1	AO2 4.1.2.6 4.2.2.4
02.3	F_2		1	AO1 4.1.1.1 4.1.2.6
02.4	the reactivity decreases (going down Group 7) (because) chlorine displaces bromine and iodine (and) bromine displaces iodine **or** iodine does not react	allow the reactivity decreases from chlorine to iodine allow (because) chlorine has two reactions allow (because) neither bromine nor iodine can displace chlorine allow (and) bromine has one reaction **or** iodine has no reactions allow (and) iodine cannot displace bromine	1 1 1	AO1 4.1.2.6 AO3 4.1.2.6 AO3 4.1.2.6
02.5	80		1	AO2 4.3.1.2

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(1.2 kg =) 1200 (g) **or** (900 g =) 0.9 (kg)	an answer of 75 (%) scores **2** marks	1	AO2 4.3.3.1
	$(\frac{900}{1200} \times 100) = 75(\%)$ **or** $(\frac{0.9}{1.2} \times 100) = 75(\%)$	allow an answer correctly calculated from: $(\frac{900}{\text{incorrect attempt at conversion of 1.2}} \times 100)$ **or** $(\frac{\text{incorrect attempt at conversion of 900}}{1.2} \times 100)$	1	
Total			**9**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	nucleus neutron neutron electron proton	must be in this order	1 1 1 1 1	AO1 4.1.1.3 4.1.1.4 4.1.1.5
03.2	(A_r) $\frac{(63 \times 70) + (65 \times 30)}{100}$ = 63.6	an answer of 63.6 scores **2** marks	1 1	AO2 4.1.1.6
03.3	copper / Cu	allow ecf from answer to question **03.2**	1	AO2 4.1.1.1
03.4	$\frac{1.2 \times 10^{-10}}{10\,000}$ **or** $1.2 \times 10^{-10} \times 1 \times 10^{-4}$ $= 1.2 \times 10^{-14}$ (m)	an answer of 1.2×10^{-14} (m) scores **2** marks a correct answer not in standard form scores **1** mark	1 1	AO2 4.1.1.5
Total			**10**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	3.6 (cm^3)		1	AO2 4.4.3.4
04.2	hydrogen line only		1	AO3 4.4.3.4
04.3	both lines		1	AO3 4.4.3.4
04.4	graphite has delocalised electrons		1	AO1 4.2.3.2
04.5	**cathode** zinc (1) **anode** chlorine (1) hydrogen (1) bromine (1)	do **not** accept chloride allow **1** mark if chlorine and zinc the wrong way around do **not** accept bromide allow **1** mark if bromine and hydrogen the wrong way around	1+1 1+1	AO2 4.4.3.2 4.4.3.4
Total			**8**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gas		1	AO1 4.2.2.2
05.2	the gas escapes	allow carbon dioxide escapes do **not** accept references to evaporation	1	AO1 4.3.1.3
05.3	5.12 (g)		1	AO2 4.3.1.3
05.4	4.00 (g) trial 1	allow 2.89 written in either space, or ringed in the table, unless contradicted by mass of copper carbonate or trial number	1	AO3 4.3.1.3
05.5	reheat (and reweigh) until constant mass	 an answer of heat to constant mass scores **2** marks if no other mark scored allow for **1** mark heat for longer **or** (heat at a) higher temperature **alternative approach**: (1) continue heating and pass gas through limewater (1) until the (lime)water stops bubbling **or** until the limewater no longer turns cloudy	1 1	AO3 4.3.1.3

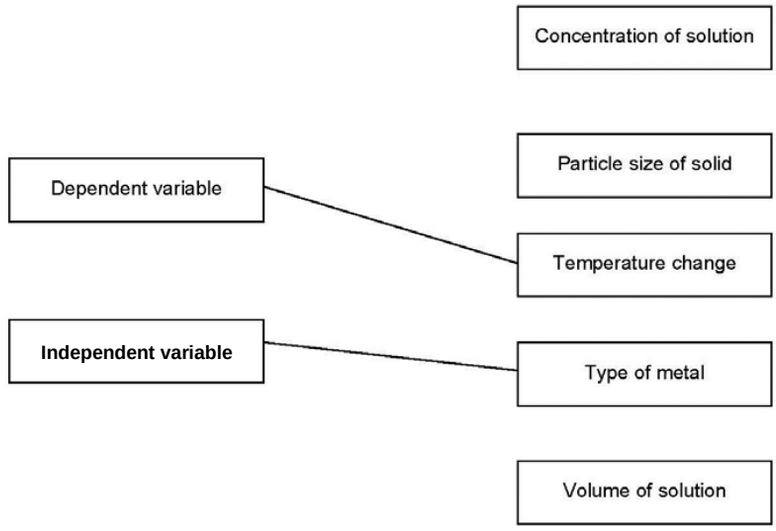
4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	straight line of best fit	must touch at least 5 of the 6 plots	1	AO2 4.3.1.3
05.7	correct value read from line of best fit in Figure 8	allow tolerance of ± ½ small square	1	AO2 4.3.1.3
05.8	(mass =) $168 \times \frac{\text{answer from question } \mathbf{05.7}}{8.4}$	a correctly calculated value from their answer to question **05.7** scores **2** marks allow (mass =) answer from question **05.7** × 20	1	AO2 4.3.1.3
	correctly calculated value (g)		1	
Total			**10**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	 allow **one** mark if answers are reversed		1 1	AO1 4.5.1.1
06.2	polystyrene is a better insulator		1	AO3 4.5.1.1
06.3	both bars labelled both bars correctly plotted	 allow tolerance of ± ½ small square ignore width and spacing of bars if no other mark scored, allow **1** mark for any one bar correctly plotted and labelled	1 1	AO2 4.5.1.1

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	temperature increases **or** temperature does not decrease	ignore because it is exothermic allow (because) energy / 'heat' is transferred to the surroundings energy / 'heat' is not taken in from the surroundings allow the energy of the products is less than the energy of the reactants	1	AO3 4.5.1.1
06.5	(most reactive) magnesium (zinc) nickel	this order only	1	AO3 4.5.1.1 4.4.1.2
06.6	suitable method described the observations / measurements required to place in order an indication of how results would be used to place the unknown metal in the reactivity series **approaches that could be used:** **approach 1:** add the unknown metal to copper sulfate solution (1) measure temperature change (1) place the metals in order of temperature change (1)		1 1 1	AO3 4.4.1.2 4.5.1.1

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6 cont.	**approach 2:** add the metal to salt solutions of the other metals **or** heat the metal with oxides of the other metals (1) measure temperature change (only if salt solutions used) **or** observe whether a chemical change occurs (1) compare temperature change or whether there is a reaction to place in correct order (1) **approach 3:** add all of the metals to an acid (1) measure temperature change or means of comparing rate of reaction (1) place the metals in order of temperature change or rate of reaction (1) **approach 4:** set up electrochemical cells with the unknown metal as one electrode and each of the other metals as the other electrode (1) measure the voltage of the cell (1) place the metals in order of voltage (1)			
06.7	D		1	AO1 4.5.1.2
06.8	C		1	AO1 4.5.1.2
Total			**12**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	sodium oxide	allow Na_2O	1	AO2 4.1.1.1 4.1.2.5 4.4.1.1
07.2	oxidation		1	AO1 4.4.1.1
07.3	13		1	AO1 4.4.2.4
07.4	sodium hydroxide		1	AO2 4.1.1.1
07.5	OH^-		1	AO1 4.4.2.4
07.6	(volume =) $\frac{250}{1000}$ or ¼ or 0.25 (dm^3) **or** (mass per cm^3 =) $\frac{40}{1000}$ (g) or 0.04 (g) ($\frac{250}{1000}$ × 40 =) 10 (g)	an answer of 10 (g) scores **2** marks	1 1	AO2 4.3.2.5

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	all points correct	allow a tolerance of ± ½ a small square allow **1** mark for 3 points correct ignore any attempt at a line of best fit	2	AO2 4.1.2.5
07.8	39 (°C)	allow any value from 34 to 46 (°C)	1	AO2 4.1.2.5
Total			**10**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any **one** from: • metal • (metal) hydroxide • (metal) carbonate • alkali	allow named example allow correct formula ignore base allow ammonium hydroxide allow ammonium carbonate allow soluble base allow ammonia	1	AO1 4.4.2.1 4.4.2.2 4.4.2.3
08.2	$Ca(NO_3)_2$	allow $Ca^{2+}(NO_3^-)_2$	1	AO2 4.4.2.2

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Mark	AO / Spec. Ref.
01.3	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.4.2.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • use magnesium oxide and sulfuric acid • add sulfuric acid to a beaker • warm sulfuric acid • add magnesium oxide • stir • continue adding until magnesium oxide is in excess • filter • using a filter paper and funnel • to remove excess magnesium oxide • heat solution in an evaporating basin • to crystallisation point • leave to crystallise • pat dry with filter paper credit may be given for diagrams		
Total			**8**

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	FeS_2	do **not** accept equations	1	AO2 4.2.1.3
09.2	26 30 26	must be this order	1 1 1	AO2 4.1.1.4 4.1.1.5
09.3	any **two** from: • iron has a high(er) melting / boiling point • iron is dense(r) • iron is hard(er) • iron is strong(er) • iron is less reactive • iron has ions with different charges • iron forms coloured compounds • iron can be a catalyst	allow the converse statements for sodium allow transition metal for iron allow Group 1 metal for sodium ignore references to atomic structure ignore iron rusts allow iron is less malleable / ductile allow specific reactions showing difference in reactivity allow iron is magnetic	2	AO1 4.1.2.5 4.1.3.1 4.1.3.2

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	carbon is more reactive (than nickel)	allow converse	1	AO1 4.4.1.2 4.4.1.3
	(so) carbon will displace / replace nickel (from nickel oxide) **or** (so) carbon will remove oxygen (from nickel oxide)	allow (so) nickel ions gain electrons allow (so) carbon transfers electrons to nickel (ions)	1	
09.5		an answer of 67.8 (%) scores **3** marks an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores **2** marks an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps		AO2 4.3.3.2
	(total M_r of reactants =) 87		1	
	(percentage atom economy) $= \frac{59}{87} \times 100$	allow (percentage atom economy) $= \frac{59}{\text{incorrectly calculated } M_r} \times 100$	1	
	= 67.8 (%)	allow an answer from an incorrect calculation to 3 sig figs	1	
Total			**11**	

4.2.2.7 Properties of metals and alloys

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	copper, zinc, sodium chloride solution		1	AO2 4.5.2.1
10.2	a reactant is used up	allow the reaction stops allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant	1	AO1 4.5.2.1
10.3	the reaction is not reversible		1	AO1 4.5.2.1
10.4	$2H_2 + O_2 \rightarrow 2H_2O$	allow fractions / multiples allow **1** mark for O_2	2	AO1 AO2 4.1.1.1 4.5.2.2

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="5">10.5</td><td>Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.</td><td>5–6</td><td rowspan="5">AO3

AO3

AO2

4.4.3.4
4.5.2.1
4.5.2.2</td></tr>
<tr><td>Level 2: Some logically linked reasons are given. There may also be a simple judgement.</td><td>3–4</td></tr>
<tr><td>Level 1: Relevant points are made. This is not logically linked.</td><td>1–2</td></tr>
<tr><td>No relevant content</td><td>0</td></tr>
<tr><td colspan="2">Indicative content

reasons why fuel cells could be judged as better

<table><tr><th>from the table</th><th>from other knowledge</th></tr><tr><td>• time for refuelling a fuel cell is faster than recharging
or
a fuel cell does not need to be recharged
• a fuel cell has a greater range</td><td>• hydrogen can be renewable if made by electrolysis using renewable energy
• lithium-ion batteries can catch fire
• produces only water
or
no pollutants produced
• lithium-ion batteries may release toxic chemicals on disposal
• lithium-ion batteries (eventually cannot be recharged so) have a finite life</td></tr></table>
reasons why the lithium-ion battery could be judged as better

<table><tr><th>from the table</th><th>from other knowledge</th></tr><tr><td>• lithium-ion uses energy more efficiently
• cost of lithium-ion car much less
• cost of recharging much less than refuelling with hydrogen</td><td>• hydrogen is often made from fossil fuels so is not renewable
• charging points are more widely available than hydrogen filling stations
• hydrogen takes up a lot of space
or
is difficult to store
• hydrogen can be highly flammable / explosive
• no emissions produced
• (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</td></tr></table></td><td></td><td></td></tr>
<tr><td>Total</td><td colspan="2"></td><td>11</td></tr>
</table>

4.2.2.7 Properties of metals and alloys

Answer 45 · Examiner comments — June 2018 | 8462/1F | Original Q1

Question 1 (low demand)

01.1 74% of students achieved two or more marks, with 34% of students achieving all three. The vast majority of students knew that black ink would be separated by chromatography, but filtration was a popular incorrect answer for obtaining salt from seawater.

01.2 This question was not well answered. Many students did not know what to call a funnel, referring to it as a plastic cone. Other errors were to use more pieces of paper, or to suggest substituting a beaker for the conical flask. Answers which gave diagrams gained credit.

01.3 69% of students gained both marks, with about one in eight scoring neither.

01.4 51% of students scored both marks on this, the first calculation on the paper. Partial credit was given to those who calculated 2 ÷ 18 as a percentage rather than 2 ÷ 20, or who correctly calculated the percentage of metal A instead of metal B.

01.5 68% of students knew that a mixture of metals is an alloy. The most popular incorrect answer was ‘a compound’.

Answer 45 · Examiner comments — June 2018 | 8462/1F | Original Q1

01.6 48% of students realised that the correct answer is that the layers in the mixture are distorted. 25% of students thought that the correct answer is that ‘the mixture has a giant structure’. Whilst true, this statement does not give the correct explanation for the extra hardness of the mixture.

01.7 74% of students could calculate the volume of the cube correctly. The most popular distractor was 400 nm^3, with 400 nm^2 being the surface area of one face.

4.2.2.7 Properties of metals and alloys

Answer 46 · Examiner comments

June 2019 | 8462/1F | Original Q3

Question 3 (low and standard demand)

03.1 This question tested recognition of a diagram representing only one compound.

Almost half of the students identified the correct option.

The diagram representing only one element was a strong distractor.

03.2 This question tested recognition of a diagram representing a mixture of elements.

Approximately 55% of students identified the correct option.

03.3 This question tested recognition of a diagram representing a mixture of an element and a compound.

Approximately 60% of students identified the correct option.

03.4 This question tested students' ability to apply their knowledge and understanding of chromatography and crystallisation.

Approximately two-thirds of students scored both marks.

03.5 The diagram showing how a mixture of sand and water can be separated by filtration was often drawn and labelled clearly enough to score all 3 marks. The most common omissions were a filter funnel or filter paper.

03.6 Approximately two-thirds of students correctly predicted the temperature of 100 °C.

Answer 46 · Examiner comments

June 2019 | 8462/1F | Original Q3

03.7 This question which required a description of distillation was generally answered well. Almost 60% of students scored at least 3 marks.

The marks for the solution being heated and for the water being collected in the beaker were the most often scored.

Marks for the vapour cooling in the condenser and for the vapour condensing were the least often scored. Here, the term vapour / gas / steam needed to be used rather than, for example, evaporated water.

4.2.2.7 Properties of metals and alloys

Answer 50 · Examiner comments June 2023 | 8462/1F | Original Q4

Question 4 (low and standard demand)

04.1 This question discriminated well. Nearly a third succeeded in calculating the percentage of lead atoms as 20%, though it was less common to show the working as a simple mathematical expression. A response of 25% was fairly common, as a result of assuming the total number of atoms was 24 instead of adding all the atoms together. This answer scored two marks.

04.2 Few students scored both marks, although two fifths scored one mark. Many did know that it was the layers' ability to slide over each other that was reduced, but fewer knew that this was due to the different sizes of the two types of atom.

4.3 This question discriminated well, with the majority of students scoring at least one mark and about two fifths scoring all three. Students generally followed the sequence when describing the effect of the mass of tin on melting point and took note of the instruction to 'Use data from Figure 5.' Often, however, the data was contradictory, with many students quoting 60% tin rather than 62%, which meant that even though they quoted 183°C, they could not be awarded the mark for identifying the turning point.

04.4 Most students did not realise that pure tin means 100% tin, so did not read the correct value of temperature from the graph. Many gave 323 °C as a result of two errors: looking at 0% tin (ie pure lead) and misreading the scale on the y-axis.

04.5 This was well answered, with well over half choosing the correct option.

Answer 51 · Examiner comments June 2023 | 8462/2F | Original Q7

Question 7 (Low and standard demand)

07.1 Almost 70% of the students were able to identify carbon. The two distractors were seen equally as often.

07.2 Around 10% of the students were able to identify the two elements added to iron to make stainless steel and over half of them could identify just one of the metals. 'Zinc' was very often chosen as one metal in the pair.

07.3 Over half of the students gained both marks for correctly identifying both of the properties of stainless steel with a further third gaining 1 mark.

07.4 This calculation discriminated well. Approximately one quarter of students successfully completed the calculation, usually showing full details of their working.

07.5 Almost 90% of the students gained the mark by expressing the idea of strength in a variety of ways, including the positive effect of high strength in the context of aircraft.

07.6 Around one third of students gained this mark. Weaker responses did not include the consequences of the presence of tin in the alloy if used for medical purposes.

4.2.2.7 Properties of metals and alloys

Answer 52 · Examiner comments

June 2024 | 8462/2F | Original Q7

Question 7 (low and standard demand)

07.1 Approximately two out of five students gained both marks with a one in two gaining one mark. It is important that students read the question carefully as there was a significant number of students who ticked one box instead of two.

07.2 This question asked for two ways in which a greenhouse gas is released in the process described. Less than 25% of students gained both marks with just over 35% more gaining one mark. Incorrect or insufficient responses included 'heating the limestone' and general references to the equation, or that methane might escape during its combustion.

07.3 The carbonate test is poorly understood with less than 15% of students correctly identifying the substance added to the limestone and the test for carbon dioxide. Two in five students gained one mark. The most frequent incorrect response was to mistakenly identify the test as universal indicator.

07.4 Less than 35% of students gained one mark in this question, with less than 15% gaining two marks. Responses which did not gain credit included those referring to carrying heavy weights in general rather than the weight being from lorries or vehicles, responses in terms of the incorrect property from the table or failing to make a valid comparison.

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Answer 52 · Examiner comments

June 2024 | 8462/2F | Original Q7

07.5 This question proved to be easier than that for the concrete bridge with over 50% of students gaining one mark and over 35% gaining both marks. Responses which did not gain credit again included those that failed to make a valid comparison or those that simply quoted data from the table.

4.2.2.7 Properties of metals and alloys

Answer 53 · Examiner comments June 2025 | 8462/2F | Original Q3

03.1 The reversible symbol was identified or correctly described by three quarters of students. Those that did not gain the mark talked about the 'equals sign' or the 'reversible sign' without a description.

03.2 Nearly 9 in 10 students correctly identified the type of reaction as 'endothermic'.

03.3 Well in excess of half of students correctly calculated the energy change. The methods employed were varied, with none being more common.

03.4 Around half of students correctly identified both materials. Many students completely reversed the responses. If 1 mark was awarded it was most likely for correctly identifying the reinforcement.

03.5 Over half of all students

Question 3

03.1 The reversible symbol was identified or correctly described by three quarters of students. Those that did not gain the mark talked about the 'equals sign' or the 'reversible sign' without a description.

03.2 Nearly 9 in 10 students correctly identified the type of reaction as 'endothermic'.

03.3 Well in excess of half of students correctly calculated the energy change. The methods employed were varied, with none being more common.

03.4 Around half of students correctly identified both materials. Many students completely reversed the responses. If 1 mark was awarded it was most likely for correctly identifying the reinforcement.

03.5 Over half of all students were able to identify iron. Aluminium and copper were the most frequently seen incorrect answers.

Answer 53 · Examiner comments June 2025 | 8462/2F | Original Q3

03.6 Three quarters of students correctly identified clay. Poly(ethene) was the most common incorrect response.

4.2.2.7 Properties of metals and alloys

Answer 54 · Examiner comments June 2025 | 8462/2F | Original Q7

Question 7

07.1 Half of students correctly calculated the mass of gold in an 18-carat ring.

07.2 Two thirds of students identified the ratio correctly. The most common incorrect response was the wrong way round, 1:3.

07.3 Half of students knew that copper and silver are used in gold jewellery.

07.4 A common question applied to an unfamiliar context saw students struggle, even given the diagrams to help. Many students answered in terms of 24 carat gold, where the question was in terms of 18 carat gold. A common error was the idea that the metal used for alloying was harder than gold, so making the alloy harder. Reference to the given diagrams was absent. Another example of information given being ignored by students.

Answer 54 · Examiner comments June 2025 | 8462/2F | Original Q7

07.5 Half of students gained this mark, usually for the idea that iron rusts.