



GCSE MARKING SCHEME

SCIENCE - CHEMISTRY (NEW)

JANUARY 2013

INTRODUCTION

The marking schemes which follow were those used by WJEC for the year examination in GCSE SUBJECT. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

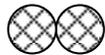
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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GCSE SCIENCE - CHEMISTRY (NEW)

C1 Mark Scheme - January 2013

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
1		(a)	(i)		1	aluminium and sodium (both needed)	Al and Na		
			(ii)		1	nitrogen dioxide and water (both need)	NO ₂ and H ₂ O		
			(iii)		1	crude oil			
		(b)	(i)		1	A			
			(ii)	I	1				
				II	1				
			(iii)	I	1	1			
				II	1	6			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
2		(a)		1	pH value of 1			
		(b)		1	nitric, hydrochloric etc	HNO ₃ , HCl etc		
		(c)		1	carbon dioxide	CO ₂		
		(d)		2	the gas is denser / heavier than air (1) does not support combustion or burning / extinguishes or puts out a flame (1)	gas doesn't burn / is not flammable	flame goes out – unless qualified	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)		1	gives heat / energy to the mixture	burns very hot	ignites / flammable	
		(b)	(i)	1	aluminium oxide + iron	$\text{Al}_2\text{O}_3 + \text{Fe}$ – ignore balancing		
			(ii)	1	iron oxide is reduced since oxygen is removed / lost			
		(c)	(i)	1	$\text{TiCl}_4 + 4\text{Na} \longrightarrow \text{Ti} + 4\text{NaCl}$			
			(ii)	1	titanium is less reactive than sodium		titanium is unreactive / not very reactive	
			(iii)	1	prevent the sodium reacting with air or oxygen / stops the sodium burning / argon not reactive / inert			
			(iv)	1	sodium is very expensive / lots of heat or energy needed	needs high temperature to work		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
4		(a)		2	increase (1) carbon dioxide given out during breathing / respiration (1)		breathing	
		(b)		2	decrease (1) carbon dioxide removed during photosynthesis / plants take in carbon dioxide (1)			
		(c)		2	increase (1) carbon dioxide given out during combustion / burning (of fuels) (1)			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
5					3	sodium bromide (1) hydrogen, sulfur and oxygen (1) K ₂ O (1)		H, S and O	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)		1	copper sulfate (solution)	CuSO ₄		
		(b)		1	anode			
		(c)	(i)	1	0.8			
			(ii)	3	plotting six correct points (2) five correct points (1) smooth line of best fit (1)			
			(iii)	1	0.66 (graph) ± 0.02			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
7	1	(a)		1	Br ₂			
		(b)		2	gas at room temperature therefore bp < 20 °C (1) above the mp / -101 °C (1)			
		(c)		1	treatment of water supply or swimming pool / sterilise water / toilet cleaners / bleach / disinfectant		clean water / water supply – needs to be qualified	poison gas
		(d)		2	gas (at room temperature) pale (yellow) colour / coloured acceptable predicted value for the melting point i.e. < -101 °C any two for (1) each	any colour 'diatomic'	F ₂ low melting point	colourless

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
8	2	(a)	(i)		1	carbon, sulfur and hydrogen	C, S and H	H ₂ oxygen	
			(ii)		1	(fuels that) cannot be replaced (when they are used up) / (fuels that) will run out		'limited amount' needs qualification	
		(b)	(i)		1	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$			
			(ii)		1	produces a '(squeaky) pop' noise when tested with a lighted splint		'pop test'	
			(iii)		2	(large amount of) electricity required to produce hydrogen (1) (storage problem due to its) explosive nature (1)	availability of hydrogen e.g. lack of service stations for vehicles	highly flammable / unsafe / unstable / expensive	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
9	3	(a)		2	over millions of years (1) remains of marine organisms (1)	missing 'marine' reference if pressure / heat mentioned		
		(b)	(i)	2	as the molecule size increases - the boiling point (range) increases / (colour) darkens / becomes more viscous / more difficult to burn / flame becomes more smoky any two for (1) each	inverse statement		
			(ii)	2	temperature lower during the winter (1) propane easier to ignite (1) butane becomes liquid at low temperature / difficult or problems for the butane to flow (1) any two for (1) each			

Question Number		Mark	
FT	HT		
10	4	6	<p>Indicative content: a description of the reaction between the carbonate and the acid – apparatus named, effervescence, exothermic, the formation of blue coloured copper sulfate solution and the addition of excess of the copper carbonate. The removal of the excess copper carbonate by filtration. Obtaining the crystals by evaporation. Either allowing the solution to evaporate at room temperature or by heating the solution and allowing the remaining solution to evaporate naturally to dryness. Credit to be given for word/symbol equation.</p> <p>5 – 6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	5				4	NH_4^+ (1) Li_2SO_4 (1) $\text{Pb}(\text{NO}_3)_2$ (1) HCO_3^- (1)	$\text{Li}^+\text{SO}_4^{2-}$ $\text{Pb}^{2+}(\text{NO}_3^-)_2$		

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)	(i)		1	sodium, magnesium and aluminium (ignore 'silicon')	Na, Mg and Al		
	6		(ii)		1	silicon	Si		
			(iii)		1	both gases (at room temperature)		very low density	
			(iv)		1	density of the metals increases across the period			
		(b)			2	the evidence supports the statement for P, Cl, Ar and/or S, Cl, Ar (1) P is lower than S/P or S does not follow the trend (1) need to look at data for other periods (1) any two for (1) each	if Si is included in their list		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	7	(a)		2	<p>reaction takes place since iron is higher in the series / more reactive than copper (1)</p> <p>brown solid formed / solution becomes colourless / decolourises (1)</p>			
		(b)		2	<p>reaction takes place since magnesium is higher in the series than hydrogen (1)</p> <p>effervescence / bubbling / temperature rise / exothermic (1)</p>	magnesium disappears		
		(c)		2	<p>no reaction takes place (1)</p> <p>aluminium is higher in the series / more reactive than carbon (1)</p>	no displacement		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	8	(a)		1	allows a valid comparison of the two volumes	apparatus was initially at room temperature	health and safety answers	
		(b)	(i)	2	volume of oxygen = $50 - 41 = 9$ (1) % of oxygen = $\frac{9}{50} \times 100 = 18\%$ (1) - correct answer only (2)			
			(ii)	1	some unreacted oxygen still left in the air / the air has not been passed over the copper sufficient number of times / not enough copper to remove all the oxygen / some of the copper unreacted			
		(c)	(i)	1	copper oxide	CuO		
			(ii)	1	increase in mass since the solid or copper has joined or reacted with oxygen			
		(d)	(i)	1	nitrogen	N ₂	N	
			(ii)	1	argon	Ar		

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	9	(a)			1	allows the ions to be mobile / move		allows electricity to flow	
		(b)			1	$2\text{Br}^- - 2\text{e}^- \rightarrow \text{Br}_2$			
		(c)	(i)		1	lead ions would gain electrons			
			(ii)		1	shiny or grey substance		lead – needs qualifying	
			(iii)		2	lead metal formed would link the two electrodes (1) lead/metals conduct electricity (1)			

Question Number		Mark	
FT	HT		
	10	6	<p>Indicative content: a description of photosynthesis and respiration producing and removing oxygen and removing and producing carbon dioxide respectively. Discussing combustion and how oxygen is reduced to produce carbon dioxide during this process. Discussing deforestation reduces the number of plants available to produce oxygen and to reduce the amount of carbon dioxide in the atmosphere which therefore increases the percentage of carbon dioxide in the air leading to global warming.</p> <p>5 – 6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

GCSE SCIENCE - CHEMISTRY (NEW)

C2 Mark Scheme - January 2013

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
1		(a)	(i)	1	neutron and proton <i>both needed, either order</i>			
			(ii)	1	number of protons equals the number of electrons / 6 protons and 6 electrons present		number of positives = number of negatives	reference to neutrons
		(b)	(i)	2	12 + 4 (1) = 16 (1) <i>If no working shown, award 2 marks for correct answer only (cao)</i> <i>Consequential marking – follow through (ft)</i>			
			(ii)	2	12/16 × 100 (1) = 75 (1) <i>If no working show, award 2 marks for cao</i> <i>Consequential marking – ft</i>			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)	(i)		1	A			
			(ii)		1	C			
			(iii)		1	B			
		(b)	(i)		1	yellow flame	orange flame	yellow	
			(ii)		1	white precipitate		white	

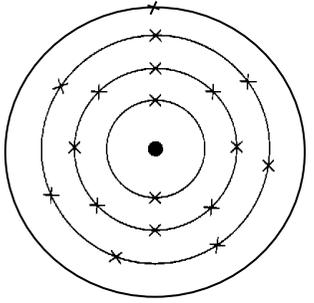
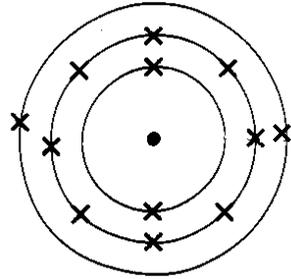
Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
3		(a)			2	photochromic (1) changes colour with changes in light (intensity) / in light (and dark) / u.v. (light) (1)		appearance changes	
		(b)			2	thermochromic (1) changes colour with changes in temperature / when hot (and cold) / when exposed to heat (1)	changes colour at a certain temperature	reference to pattern appearing	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
4		(a)	(i)	1	A and D <i>both needed, either order</i>		breathing	
			(ii)	1	D			
		(b)		1	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $			
		(c)		2	$ \left[\begin{array}{cc} \text{F} & \text{F} \\ & \\ -\text{C} & -\text{C}- \\ & \\ \text{F} & \text{F} \end{array} \right] \quad (1) $ $ \begin{array}{c} \text{H} \quad \quad \text{H} \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \quad \diagdown \\ \text{H} \quad \quad \text{Cl} \end{array} \quad (1) $	$ \left[\begin{array}{cc} \text{F} & \text{F} \\ & \\ -\text{C} & -\text{C}- \\ & \\ \text{F} & \text{F} \end{array} \right]_n $		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
5		(a)		5	<p>Method 1</p> <ul style="list-style-type: none"> • equal volumes of water sample/ actual volume given e.g. 20cm^3 • add equal volume of soap solution/ actual volume e.g. 5cm^3 • shake same number of times / shake equally • measure height of lather – <i>could be implied in final point</i> • hardest water forms least froth (accept converse) <p>(1) mark per point</p> <p>Method 2</p> <ul style="list-style-type: none"> • equal volumes of water sample/ actual volume given e.g. 20cm^3 add 1cm^3 of soap solution at a time • shake the same number of times (after adding each 1cm^3 soap sol.) • record volume of soap sol. to obtain permanent lather – <i>could be implied in final point</i> • hardest water needs most soap solution (accept converse) <p>(1) mark per point</p>			
		(b)	(i)	1	reduces heart disease / strengthens bones and teeth			tastes better
			(ii)	1	forms limescale (when heated)			
			(iii)	1	tastes better			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)			1	boiling point	size of chain / molecular mass/ density	boiling	melting point
		(b)			1	condensation / condensing / condenses			
		(c)			1	takes the temperature of the fraction / takes the temperature of the vapour			
		(d)			1	fractional distillation		distillation / fractionation	fractionating distillation

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
7		(a)		1	B and D <i>Both needed, either order</i>			
		(b)		1	C			
		(c)		2	4/8 (1) = 0.5 (1) <i>If no working shown, award 2 marks cao Consequential marking only if one of 4 or 8 are correct – ft</i>			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)	(i)					
8	1		(i)	1		2.8.8.1		
			(ii)	1		2.8.2 correct diagram of calcium structure / 2.8.8.2 [element to right of (a)(i) above rather than to right of original element drawn]		
		(b)		1	isotope			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
9	2	(a)		2	Concentration: 8 (g/dm ³) (1) Reason: experiment times close together / reaction times close together / little variation between times (1)	only 2 seconds variation between reaction times		
		(b)		1	use a light sensor / use a datalogger / same person recording the reaction times / same person adds the acid and starts the stopwatch / same person watches X disappear		use a computer	
		(c)		1	temperature		heat	catalyst
		(d)		3	<ul style="list-style-type: none"> the higher the concentration, the faster the rate the higher the concentration the shorter the reaction time (1) the higher the concentration the more particles are present (1) the more particles the greater the chance of collision the more particles present more collisions per second the more particles present more collisions in a given time (1) 		more collisions	reference to increased energy

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
10	3	(a)	(i)	1	tarnish / lose their shiny appearance	go dull / less shiny	grey / forms an oxide / corrodes	reference to rust
			(ii)	1	they react at different speeds / potassium reacts the quickest / lithium reacts the slowest / the speed at which the change occurs	reactivity increases down the group		
		(b)	(i)	3	A = bromine / Br ₂ / Br B = iodine / I ₂ / I C = chlorine / Cl ₂ / Cl all correct (2) any one correct (1) Reason: reactivity decreases down the group (1)	chlorine most reactive, iodine least		
			(ii)	3	Reactants: Fe Cl ₂ (1) Product: FeCl ₃ (1) Balancing: 2:3:2 (1) Reactants and products must be correct before balancing mark can be awarded	multiples of 2 and 3 e.g. 4:6:4		

Question Number		Mark	
FT	HT		
11	4	6	<p>Indicative content: Reference to sedimentation, filtration and chlorination together with the reason for each process e.g.</p> <p>sedimentation / settling tank: removal of large insoluble particles</p> <p>filtration / filter bed: removal of small insoluble particles removal of bacteria / germs / micro-organisms</p> <p>chlorination: kills remaining bacteria / germs / micro-organisms</p> <p>5 – 6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	5	(a)			3	All points plotted correctly $\pm\frac{1}{2}$ square (2) All but one point plotted correctly (1) Suitable line – judgement by eye (1) Consequential marking – ft			
		(b)			1	67 ± 1 Consequential marking – ft			
		(c)			2	$60^{\circ}\text{C} = 40$ $24^{\circ}\text{C} = 22$ both needed for (1) 18 (1) Consequential marking – ft			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	6	(a)		3	<p>Two discrete diagrams needed:</p> <ul style="list-style-type: none"> - diagram 1 showing transfer of electrons - diagram 2 showing ions <p>Diagram 1 Calcium atom loses 2 electrons (1) Two fluorine atoms gain 1 electron each (1)</p> <p>Diagram 2 Ca²⁺ and 2 × F⁻ ions formed (1) <i>octet of electrons around F not needed</i> <i>discrete pair of ions needed for this mark</i></p>			
		(b)		2	<p>three shared pairs of electrons (P-F's) (1)</p> <p>octets of electrons around P and all three Fs (1)</p>			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	7	(a)	(i)	3	A bromine / Br ₂ (1) B ethane / C ₂ H ₆ / structural formula (1) C polyethene / polythene (1)			
			(ii)	1	addition			additional
			(iii)	I	Reason: weak bonds between chains / molecules / chains not linked together Accept labelled diagram	forces = bonds	layers	
				II	thermoplastic	thermosoftening		
		(b)		3	mass/A_r 0.96/12 and 0.2/1 (1) = 0.08 = 0.2 ratio 1 2.5 (1) formula C ₂ H ₅ (1) Consequential marking – ft	C ₄ H ₁₀		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	8	(a)	(i)	2	Any two for (1) each <ul style="list-style-type: none"> All the water samples are hard / become softer X is not softened by boiling / X is permanently hard Y and Z are softened by boiling / Y and Z are temporary hard 			
			(ii)	2	Any two for (1) each <ul style="list-style-type: none"> Ca²⁺ (and Mg²⁺) present / X has the highest Ca²⁺ / Mg²⁺ content X has the highest sulfate (ion) content Y and Z contain high hydrogencarbonate (ion) content 		reference to only Mg ²⁺ X is the hardest	
		(b)	(i)	2	Ca²⁺/Mg²⁺ (in hard water) ions (1) exchanged with Na⁺ ions(in resin) / swapped with Na⁺ ions (in resin) (1)	replace	reference to 'displace'	'react with'
			(ii)	1	Any one for (1) <ul style="list-style-type: none"> resin needs regular replenishing / regeneration (with Na⁺ ions) disposal of waste water (after regeneration) / Na⁺ ions pollute water iron fouling bacteria contamination chlorine contamination 	Na ⁺ ions could be bad for heart	cost of process cost of sodium solution for regeneration	

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	9				3	$M_r(\text{NaHCO}_3) = 84$ $M_r(\text{Na}_2\text{CO}_3) = 106$	Moles approach $M_r(\text{NaHCO}_3) = 84$ $M_r(\text{Na}_2\text{CO}_3) = 106$		
						both needed (1)	} (1)		
						$2(84) \longrightarrow 1(106)$ $168 \quad \quad \quad 106$ $84 \quad \quad \quad 53$	$8.4/84 = 0.1$		
						2:1 ratio (1)	$2 \longrightarrow 1$ $0.1 \quad \quad \quad 0.05$	} (1)	
						$8.4 \longrightarrow 5.3$ cao (3)	$0.05 \times 106 = 5.3$	} (1)	

Question Number		Mark	
FT	HT		
	10	6	<p>Indicative content: For diamond and graphite – reference made to bonding, structure and properties related to uses</p> <p>Diamond Bonding: uniform covalent / strong covalent bonds throughout / each carbon atom joined to four others Structure: giant molecular / covalent Properties and uses: hard – drill bits transparent /sparkly – jewellery</p> <p>Graphite Bonding: strong bonds within layers and weak bonds between layers / carbon atoms / each joined to three others Structure: giant molecular / covalent in layers Properties and uses: soft – pencils electrical conductor – electrodes</p> <p>5 – 6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>



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