

2025 DHS Preliminary Examination
H2 Chemistry 9729 Paper 1
Suggested Solutions

Answer Key

1	2	3	4	5
D	B	A	C	D

6	7	8	9	10
A	B	D	A	C

11	12	13	14	15
D	C	B	A	C

16	17	18	19	20
B	B	D	D	A

21	22	23	24	25
D	C	D	C	A

26	27	28	29	30
C	D	B	A	C

1	D	
x	A	Since both particles have a positive angle of deflection, they are deflected in the same direction towards the same plate. Similar to ${}^4\text{He}^{2+}$, X must be positively charged.
x	B	The beam of positively charged particles X travels in a <u>curved</u> path towards the negatively charged plate.
x	C	Charge to mass ratio of ${}^{12}\text{C}^+ = +\frac{1}{12}$ Charge to mass ratio of ${}^4\text{He}^{2+} = +\frac{2}{4} = +\frac{1}{2}$ Since angle of deflection is proportional to charge to mass ratio, the angle of deflection of ${}^{12}\text{C}^+$ is expected to be $\frac{1}{6}(1^\circ) = +0.17^\circ$
✓	D	None of the above options are correct.

2	B
	1. Determine the number of neutrons in Sr (find proton number of Sr using <i>Data Booklet</i> .) $\Rightarrow 84 - 38 = 46$
	2. Find number of electrons present in Sr^{2+} (using proton number of Sr given in <i>Data Booklet</i> .) $\Rightarrow 38 - 2 = 36$ \Rightarrow W has 36 electrons
	3. Find number of protons present in W W : 36 protons
	4. Calculate the nucleon number of W W : $36 + 46 = 82$
	The outer electronic configuration of W is $4s^2 4p^6$ and hence a total of four orbitals (one 4s and three 4p) are occupied in the valence shell.

3	A (1, 2 and 3 only)	
	The molecules have the following linear structures: O=C=O, S=C=S and O=C=S	
✓	1	C=O and C=S are polar covalent bonds due to the difference in electronegativity between the atoms.
✓	2	Each C=O and C=S bond contains one sigma and one pi bond so each molecule contains two sigma and two pi bonds.
✓	3	The dipole moments of the polar bonds are equal and opposite in O=C=O and S=C=S molecules so they cancel out and the

		molecules are non-polar. There exists only instantaneous dipole-induced dipole (id-id) interactions between these non-polar molecules.
		As O is more electronegative than S, $\text{C}=\text{O}$ bond is more polar than $\text{C}=\text{S}$ bond and there is a net dipole moment in $\text{O}=\text{C}=\text{S}$. Hence, COS molecule is polar and it has both id-id and permanent dipole-permanent dipole interactions between molecules.
x	4	$\text{O}=\text{C}=\text{S}$ has a smaller, less polarisable electron cloud than $\text{S}=\text{C}=\text{S}$. Hence, $\text{O}=\text{C}=\text{S}$ has weaker id-id interactions between molecules than $\text{S}=\text{C}=\text{S}$.

4	C	
x	A	Ice has a simple molecular structure with hydrogen bonds between water molecules. There are covalent bonds between atoms in the water molecules.
x	B	Iodine, I ₂ , has a simple molecular structure and is a non-polar molecule. There exists instantaneous dipole–induced dipole (id–id) interactions between molecules and covalent bond between iodine atoms in a molecule.
✓	C	Sodium nitrate, NaNO ₃ , has a giant ionic structure with ionic bonds between oppositely charged Na ⁺ and NO ₃ [–] ions. Within the NO ₃ [–] ion, there are covalent bonds between N and O atoms.
x	D	Manganese has a giant metallic structure with metallic bonds between the positively charged metal cations and sea of delocalised electrons.

5	D
	$2\text{H}_2\text{S} + 3\text{O}_2 \rightarrow 2\text{SO}_2 + 2\text{H}_2\text{O}$ $\text{CS}_2 + 3\text{O}_2 \rightarrow \text{CO}_2 + 2\text{SO}_2$ Hence, $\text{SO}_2 : \text{CO}_2$ will be 4 : 1. \Rightarrow Options A & C are incorrect.
	In the 60 cm^3 mixture, there is 40 cm^3 of H_2S and 20 cm^3 of CS_2 .
	40 cm^3 of H_2S will form 40 cm^3 of SO_2 . 20 cm^3 of CS_2 will form 20 cm^3 of CO_2 and 40 cm^3 of SO_2 .
	Hence, total volume of acidic gases, CO_2 and SO_2 , $= 40 + 20 + 40 = 100 \text{ cm}^3$
	These acidic gases will react with NaOH(aq) and cause a reduction in gas volume.

6	A	
✓	A	$pV = nRT = mRT/M \Rightarrow \text{density} = m/V = pM/RT$ Since density = pM/RT and M , T and R are constants, density is directly proportional to p \Rightarrow graph of density against p is an upward sloping straight line starting from the origin This graph does not represent the behaviour of a fixed mass of an ideal gas.

x	B	Since $pV = nRT$ and n , p and R are constants, V is directly proportional to T (in K) \Rightarrow graph of V against T is an upward sloping straight line starting from the origin
x	C	Since $pV = nRT$ and n and R are constants, $pV/T = \text{constant}$ \Rightarrow graph of pV/T against p is a horizontal straight line.
x	D	Since $pV = nRT$ and n , V and R are constants, $p/T = \text{constant}$ \Rightarrow graph of p against p/T is a vertical straight line.

7	B	
		Oxidation half-equation: $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$ $\text{Fe}^{2+} \equiv \text{e}^-$ amount of electrons transferred $= \frac{30.0}{1000} \times 0.200 = 0.00600 \text{ mol}$ $\frac{\text{amount of electrons}}{\text{amount of nitrate ions}} = \frac{0.00600}{0.00200} = \frac{3}{1}$ The oxidation state of nitrogen decreases by 3 from +5 in NO_3^- to +2.
x	A	The oxidation state of N in N_2 is 0.
✓	B	The oxidation state of N in NO is +2.
x	C	The oxidation state of N in NO_2^- is +3.
x	D	The oxidation state of N in NO_2 is +4.

8	D	
		K is phosphorus as the P^{3-} has the largest ionic radii amongst the Period 3 ions. The cations are smaller as they have one less shell of electrons compared to the anions. Amongst the isoelectronic anions, P^{3-} has the lowest nuclear charge hence the weakest electrostatic forces of attraction for its valence electrons. L is silicon. Large amount of energy is required to break the strong and extensive covalent bonds between Si atoms in the 3-dimensional network structure. M is magnesium. It has the second highest number of delocalised electrons in its solid lattice, hence the second highest electrical conductivity behind aluminium. In order of increasing atomic number: M (magnesium) < L (silicon) < K (phosphorus)

9	A (1 and 2 only)	
✓	1	Electronegativity decreases down every group as the number of electron shells increases. This leads to an increase in screening effect. Despite the increase in nuclear charge, the ability of the atom to attract bonding electrons decreases.
✓	2	Reducing power of Group 2 elements increases as $E^\ominus(\text{M}^{2+}/\text{M})$ gets increasingly negative.

x	3	As the size of electron cloud increases down the group, polarisability increases. More energy is required to overcome the stronger instantaneous dipole-induced dipole interactions between X_2 molecules. Boiling point increases and volatility (ease of vaporisation) decreases.
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10	C	
x	A	$2\text{Na(s)} + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{Na}_2\text{O(s)}$ The number of moles of gases decreases from $\frac{1}{2}$ to 0 per mole of $\text{Na}_2\text{O(s)}$ formed from its constituent elements at standard conditions.
x	B	$\text{Mg(s)} + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{MgO(s)}$ The number of moles of gases decreases from $\frac{1}{2}$ to 0 per mole of MgO(s) formed from its constituent elements at standard conditions. The ΔS_f^\ominus of MgO(s) is expected to be similar to that of $\text{Na}_2\text{O(s)}$ since the change in number of gaseous particles is the same for both reactions.
✓	C	$\text{Si(s)} + \text{O}_2(\text{g}) \rightarrow \text{SiO}_2(\text{s})$ The number of moles of gases decreases from 1 to 0 per mole of $\text{SiO}_2(\text{s})$ formed from its constituent elements at standard conditions. The ΔS_f^\ominus of $\text{SiO}_2(\text{s})$ is the most negative as its formation results in the largest decrease in number of gaseous particles.
x	D	$\text{S(s)} + \text{O}_2(\text{g}) \rightarrow \text{SO}_2(\text{g})$ The number of moles of gases does not change as one mole of $\text{SO}_2(\text{g})$ is formed from its constituent elements at standard conditions.

11	D	
		The magnitude of lattice energy of an ionic compound is dependent on the product of ionic charge and the sum of ionic radii: $ \text{L.E.} \propto \left \frac{q_+ q_-}{r_+ + r_-} \right $
x	A	For TiF_3 , $ \text{L.E.} \propto \left \frac{(+3) \times (-1)}{0.067 + 0.136} \right = 14.8$
x	B	For FeF_3 , $ \text{L.E.} \propto \left \frac{(+3) \times (-1)}{0.055 + 0.136} \right = 15.7$
x	C	For TiO , $ \text{L.E.} \propto \left \frac{(+2) \times (-2)}{0.086 + 0.140} \right = 17.7$
✓	D	For FeO , $ \text{L.E.} \propto \left \frac{(+2) \times (-2)}{0.061 + 0.140} \right = 19.9$

12	C	
		heat transferred to water = $mc\Delta T$ $= 500 \times 4.18 \times 7.5 = 15675 \text{ J}$ heat released by combustion $= \frac{100}{70} \times 15675 = 22392 \text{ J} = 22.392 \text{ kJ}$ energy released per gram of fuel burnt $= 22.392 \div 0.7 = 32.0 \text{ kJ g}^{-1}$

13	B
	Removal of aspirin
	$x(100\%) \xrightarrow{t_{1/2}} \frac{x}{2}(50\%) \xrightarrow{t_{1/2}} \frac{x}{4}(25\%) \xrightarrow{t_{1/2}} \frac{x}{8}(12.5\%)$
	$3 t_{1/2} = 6 \text{ h}$ $t_{1/2} = 2 \text{ h}$ rate constant, $k = \ln 2 / t_{1/2}$ $= (\ln 2) / 2$ $= 0.347 \text{ h}^{-1}$

14	A
	From the slow step, $\text{rate} = k[\text{P}_2][\text{Q}]$ However, P_2 is an intermediate and should not appear in the rate equation. From the fast step, $K_c = \frac{[\text{P}_2]}{[\text{P}]^2}$ $[\text{P}_2] = K_c[\text{P}]^2$ Thus, $\text{rate} = kK_c[\text{P}]^2[\text{Q}]$ $\text{rate} = k'[\text{P}]^2[\text{Q}]$

15	C
x	A
	Addition of catalyst does not shift the position of equilibrium as it increases the rate of both forward and backward reaction to the same extent. K_c remains unchanged as it is temperature dependent.
x	B
	Addition of inert gas at constant volume does not change the partial pressure of the gaseous reactants and products. Hence position of equilibrium will not shift. K_c remains unchanged as it is temperature dependent.
✓	C
	Decrease in temperature will shift the position of equilibrium to the right to favour exothermic reaction to release heat. Hence, there is an increase in [products] and decrease in [reactants]. K_c will increase.
x	D
	Decrease in volume of vessel will increase the partial pressures of all gases, hence shift position of equilibrium to the right to decrease the number of gaseous particles. K_c remains unchanged as it is temperature dependent.

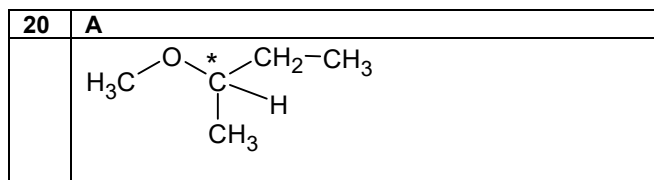
16	B (1 and 2 only)																									
	<table><tr><th>solution</th><th>concentration / mol dm⁻³</th><th>pH</th><th>[H⁺]</th><th>[OH⁻]</th></tr><tr><td>E</td><td>1.0</td><td>4.0</td><td>10⁻⁴</td><td></td></tr><tr><td>F</td><td>1.0</td><td>5.8</td><td></td><td></td></tr><tr><td>G</td><td>0.01</td><td>12.0</td><td>10⁻¹²</td><td>0.01</td></tr><tr><td>H</td><td>0.01</td><td>2.0</td><td>0.01</td><td></td></tr></table>	solution	concentration / mol dm ⁻³	pH	[H ⁺]	[OH ⁻]	E	1.0	4.0	10 ⁻⁴		F	1.0	5.8			G	0.01	12.0	10 ⁻¹²	0.01	H	0.01	2.0	0.01	
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	<p>Since [H⁺] << [E] and [H⁺] << [F], E and F are weak acids or acidic salts that dissociate partially. E and F are CH₃COOH and NH₄Cl.</p> <p>Since [H⁺] = [H], H is a strong acid, HCl, that dissociates fully.</p>																									

		Since $[\text{OH}^-] = [\text{G}]$, G is a strong base, NaOH , that dissociates fully.
✓	1	Statement is correct as explained above.
✓	2	amount of E = $\frac{10}{1000} \times 1.0$ $= 0.01 \text{ mol}$ amount of G = $\frac{500}{1000} \times 0.01$ $= 0.005 \text{ mol}$ Resulting solution contains excess E (weak acid) and its salt. Hence, a buffer solution is produced.
x	3	Resulting solution is a strong acid and a weak acid. Hence, a buffer solution is not formed.

17	B
	$[\text{H}^+] = 10^{-7.4} = 3.981 \times 10^{-8} \text{ mol dm}^{-3}$ $[\text{OH}^-] = K_w \div [\text{H}^+] = 2.4 \times 10^{-14} \div 3.981 \times 10^{-8}$ $= 6.03 \times 10^{-7} \text{ mol dm}^{-3}$

18	D (2 and 3 only)
x	1
	In a solution saturated with both BaSO_4 and PbSO_4 , let the solubility of BaSO_4 and PbSO_4 be x' and y' mol dm ⁻³ respectively. Due to common ion effect, $x' < x$ and $y' < y$ $[\text{Ba}^{2+}] = x' \text{ mol dm}^{-3}$ $[\text{Pb}^{2+}] = y' \text{ mol dm}^{-3}$ $[\text{SO}_4^{2-}] = (x' + y') \text{ mol dm}^{-3} < (x + y) \text{ mol dm}^{-3}$ $= [\text{Ba}^{2+}] + [\text{Pb}^{2+}]$
✓	2
	$\text{BaSO}_4(\text{s}) \rightleftharpoons \text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$ In the presence of common ion SO_4^{2-} , position of above equilibrium will shift to the left to decrease $[\text{SO}_4^{2-}]$, hence solubility of BaSO_4 will decrease. $[\text{Ba}^{2+}] < x \text{ mol dm}^{-3}$
✓	3
	Refer to statement 1 for explanation.

19	D
	<div style="display: flex; justify-content: space-around;"> <div>(A) σ bond formed by 1s–2sp overlap</div> <div>(B) π bond formed by 2p–2p overlap</div> </div> <div style="text-align: center;"> $\text{H}-\text{C}\equiv\text{C}-\text{CH}_3 \rightleftharpoons \text{H}_2\text{C}=\text{C}=\text{CH}_2$ </div> <div style="text-align: center;"> (C) sp hybridised carbons </div> <p>D is incorrect as the C–C single bond in propyne is $\text{sp}-\text{sp}^3$ overlap, while that in propane ($\text{CH}_3-\text{CH}_2-\text{CH}_3$) is sp^3-sp^3 overlap. The bond length in propyne is shorter as sp orbital has more s character, resulting in more effective overlap.</p>



22	C
	From the rate of formation of ppt, P is $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$, Q is $\text{X}-\text{C}_6\text{H}_4\text{CH}_3$, R is $\text{C}_6\text{H}_5\text{CH}_2\text{I}$, S is $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$.
x	A R should have the longest and weakest C–X bond since it is the most reactive.
x	B Reacting Cl_2 with methylbenzene in the presence of UV light (Free Radical Substitution reaction) gives S , $\text{C}_6\text{H}_5\text{CH}_2\text{Cl}$ not R , $\text{C}_6\text{H}_5\text{CH}_2\text{I}$.
✓	C Q can be $\text{BrC}_6\text{H}_4\text{CH}_3$ formed from $\text{C}_6\text{H}_5\text{CH}_3 + \text{Br}_2$ in the presence of AlBr_3 . This is an electrophilic substitution reaction and the product is $\text{Br}-\text{C}_6\text{H}_4\text{CH}_3$.
x	D Only P , R and S give benzoic acid upon side-chain oxidation.

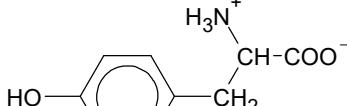
21	D (none of the above)
x	1 <div> <p>The molecule does not have a chiral carbon, so the product does not rotate plane polarised light.</p> </div>
x	2 <div> <p>OH^- nucleophile attacks the positively charged carbon which is trigonal planar from the top and the bottom of the plane with <u>equal</u> probability. A racemic mixture is formed and does not rotate plane polarised light.</p> </div>
x	3 <div> <p>CN^- nucleophile attacks the electron deficient trigonal planar carbonyl carbon from the top and the bottom of the plane with <u>equal</u> probability. A racemic mixture is formed and does not rotate plane polarised light.</p> </div>
x	4 <div> <p>Br_2 electrophile attacks the trigonal planar $\text{C}=\text{C}$ carbon to form a carbocation intermediate. In the fast step, the Br^- nucleophile attacks the trigonal planar carbocation from the top and the bottom of the plane with <u>equal</u> probability. A mixture of three stereoisomers, A, B and C are formed. A is a meso compound with an internal plane of symmetry. It is optically inactive. B and C are enantiomers that are formed in a 1:1 ratio. The resulting product mixture does not rotate plane polarised light.</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;"> <p>A</p> </div> <div style="text-align: center;"> <p>B</p> </div> <div style="text-align: center;"> <p>C</p> </div> </div> </div>

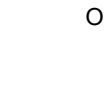
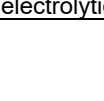
23	D
	Compound E has the following structure:
x	A $\text{NaOH}(\text{alcoholic})$ will react with neither compound since there is no $\text{R}-\text{X}$ ($\text{X} = \text{Cl}$, Br or I) group for elimination to occur.
x	B 2,4-DNPH will only react with E since carbonyl group is present in E .
x	C Warm alkaline aqueous iodine will react with neither compounds. (negative triiodomethane test) since both do not have $-\text{COCH}_3$ or $-\text{CH}(\text{OH})\text{CH}_3$.
✓	D Both compounds have adjacent H and OH to undergo elimination with hot alumina (i.e., heat with Al_2O_3) to form alkene.

24	C
	<p>Sodium hydroxide reacts with phenols and carboxylic acids: $\text{C}_6\text{H}_5\text{OH} \equiv \text{NaOH}$ [Note: NaOH does not react with alcohols.]</p> <p>Therefore, 1 mol of saligenin reacts with 1 mol of NaOH.</p> <p>Sodium metal reacts with alcohols, phenols and carboxylic acids: $\text{ROH} \equiv \text{Na}$ $\text{C}_6\text{H}_5\text{OH} \equiv \text{Na}$</p> <p>Equations: $\text{ROH} + \text{Na} \rightarrow \text{RO}^-\text{Na}^+ + \frac{1}{2} \text{H}_2$ $\text{C}_6\text{H}_5\text{OH} + \text{Na} \rightarrow \text{C}_6\text{H}_5\text{O}^-\text{Na}^+ + \frac{1}{2} \text{H}_2$</p> <p>Saligenin contains a ROH (primary alcohol) and a $\text{C}_6\text{H}_5\text{OH}$ (phenolic group). Therefore, 1 mol of saligenin requires 2 mol of Na to produce 1 mol of H_2.</p>

25	A	
✓	A	Has both alcohol group and aliphatic aldehyde group
✗	B	Has an aliphatic aldehyde group only. Aromatic aldehyde group also present.
✗	C	Has an alcohol group only. Aliphatic ketone group also present.
✗	D	Has an aliphatic aldehyde group only. Phenol group also present but does not react with PCl_5

26	C	<p style="text-align: center;">compound Z</p> <p>Z undergoes basic hydrolysis to form 4 carbon containing products, out of which two of them are the same.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> $\begin{array}{c} \text{CH}(\text{CH}_3)\text{OH} \\ \\ \text{H}_2\text{N}-\text{C}-\text{COO}^- \\ \\ \text{H} \end{array}$ </div> <div style="text-align: center;"> $\begin{array}{c} \text{CH}_2\text{COO}^- \\ \\ \text{H}_2\text{N}-\text{C}-\text{COO}^- \\ \\ \text{H} \end{array}$ </div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> $\begin{array}{c} \text{O}^- \\ \\ \text{C}_6\text{H}_4 \\ \\ \text{H}_2\text{N}-\text{C}-\text{COO}^- \\ \\ \text{H} \end{array}$ </div> <div style="text-align: center;"> $\begin{array}{c} \text{CH}_2\text{COO}^- \\ \\ \text{H}_2\text{N}-\text{C}-\text{COO}^- \\ \\ \text{H} \end{array}$ </div> </div>
✓	A	
✓	B	Primary amide undergoes basic hydrolysis to produce basic NH_3 gas.
✗	C	Three moles of CH_3COCl are required (one mole with secondary alcohol, one mole with phenol and one mole with primary amine). All of these functional groups undergo condensation with CH_3COCl .
✓	D	<p>One mole of Na_2CO_3 is required to undergo acid–base reaction with two moles of RCOOH (carboxylic acid) in Z.</p> $\text{Na}_2\text{CO}_3 + 2\text{RCOOH} \rightarrow 2\text{RCOO}^-\text{Na}^+ + \text{CO}_2 + \text{H}_2\text{O}$

27	D (2 and 3 only)	
T	1	 <p>zwitterionic form of dopamine</p> <p>Able to form ion-dipole interactions with water, allowing it to be soluble in water</p>

F	2	<p>At a high pH of 14, all acidic groups on dopamine are deprotonated:</p> <div style="text-align: center;">  </div> <p>ionic form of dopamine at pH 14</p> <p>As it has an overall negative charge (of -3), it is attracted to the anode (positive electrode) of an electrolytic cell.</p>
F	3	<div style="text-align: center;">  </div> <p>product when reacted with Br₂(aq)</p> <p>As there are three electron-withdrawing Br atoms on the benzene ring, the negative charge of the carboxylate group is dispersed to a larger extent. This makes the carboxylate ion more stable, increasing the acid strength.</p>

28	B
	<p>As Y is the negative electrode, electrons are released at Y and Y is the anode. Oxidation of Y to Y³⁺ occurs</p> $\mathbf{Y \rightarrow Y^{3+} + 3e^{-}}$ <p>As X is the positive electrode, electrons are gained at X and X is the cathode. Reduction of X²⁺ to X occurs</p> $\mathbf{X^{2+} + 2e^{-} \rightarrow X}$ <p>$E^{\ominus}(\mathbf{X^{2+}/X})$ is more positive than $E^{\ominus}(\mathbf{Y^{3+}/Y})$</p> <p>$\Rightarrow \mathbf{X^{2+}}$ is more readily reduced than $\mathbf{Y^{3+}}$</p> <p>$\Rightarrow \mathbf{X^{2+}}$ is a stronger oxidising agent than $\mathbf{Y^{3+}}$</p> <p>$\Rightarrow \mathbf{Y}$ is a stronger reducing agent than \mathbf{X}</p>

29	A
	$Q = It$ $= 2 \times 9 \times 60 \times 60$ $= 64800 \text{ C}$ $\text{amount of } e^- \text{ passed} = 64800 \div 96500$ $= 0.67150 \text{ mol}$ $Al^{3+} + 3e^- \rightarrow Al$ $\text{mass of } Al \text{ produced} = \frac{1}{3} \times 0.67150 \times 27.0$ $= 6.04 \text{ g}$

30	C	
x	A	<p>G is $\text{Cu}(\text{OH})_2(\text{s})$. NH_3 is acting as a Bronsted-Lowry base, accepting H^+ from H_2O to produce $\text{OH}^-(\text{aq})$. Reaction I is a precipitation reaction.</p> $\text{NH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$ $\text{Cu}^{2+}(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2(\text{s})$
x	B	<p>H is $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]\text{SO}_4(\text{aq})$ and has a deep blue colour. Reaction II involves the formation</p>

✓	C	of a complex. There is no change in oxidation state i.e., not a redox reaction.
✗	D	<p>Reaction III is a ligand exchange reaction and EDTA⁴⁻ is a hexadentate ligand.</p> $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}(\text{aq}) + \text{EDTA}^{4-}(\text{aq}) \rightleftharpoons [\text{Cu}(\text{EDTA})]^{2-}(\text{aq}) + 4\text{NH}_3(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ <p>As there is an increase in number of aqueous species, entropy increases.</p>