General Instructions

Working time – 48 minutes
Write your answers using a pen in the spaces provided.
This task is marked out of 30 marks.

Question 1. **[H3, H4]** (8 marks)

(a) Identify the catchment area studied. 1M

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(b) Identify TWO possible sources of contamination in this catchment. 1M

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(c) Justify the addition of TWO chemicals to the Sydney water supply. 2M

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(d) Water can be purified by the use of microscopic membrane filters.

(i) Describe the materials use to produce such filters. 1M

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(ii) Identify ONE contaminant that can be removed from water supplies using these filters. 1M

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This question continues overleaf.

(e) (i) Identify an example of a heavy metal pollutant of water. 1M

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(ii) Outline ONE quantitative test AND ONE qualitative test that can be performed to confirm the presence of this heavy metal. 2M

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Question 2. [H4] (3 marks)

Compare the composition and uses of cationic and non-ionic detergents. 3M

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Question 3. [H3, H4, H13] (5 marks)

As a part of your research, you have gathered and presented information on a dry cell or lead-acid cell.

(a) Use the table below to summarise some of the information you have obtained about **either** the dry cell **OR** the lead acid battery. 3M

Battery selected : .....

Feature	Description
Anode composition	
Anode reaction	
Cathode reaction	
Electrolyte	
An impact on the environment	
An impact on the society	

(b) When gathering information from websites, there are certain criteria that you use to assess whether the information is to be accepted or rejected. Outline THREE criteria that should be used to make an assessment. 2M

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Question 4. [H4] (3 marks)

Discuss, using examples, the impacts of society's use of soaps/detergents on the environment. 3M

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Question 5. [H8, H10] (3 marks)

27.0 mL of 0.765 mol/L copper chloride solution is mixed with 35.8 mL of 0.645 mol/L ammonium hydroxide solution. Calculate the maximum mass of precipitate that can form. 3M

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Question 6. [H3] (3 marks)

Explain how soaps/detergents perform their job of emulsifying oil and water. 3M

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Question 7. **[H1]** (5 marks)

Evaluate how advances in the scientific understanding of the chemistry of CFCs and the ozone layer have changed the direction or nature of scientific thinking.

Marking Guidelines Task 3 2009
Year 12 CHEMISTRY

1. a.

Marking criteria	*Marks*
Identifies the catchment as the Warragamba catchment area. *[All that was required was just two words…Warragamba Dam!]*	1

1. b.

Marking criteria	*Marks*
Identifies TWO sources of contaminants	1
Identifies ONE source of contaminant OR Identifies TWO contaminants *[e.g. Two sources of contaminants may include run off from land used for agriculture and runoff from storm water that has not been properly managed]*	0.5

1. c.

Marking criteria	*Marks*
Identifies TWO chemicals added to water supplies WITH a justification for each.	2
Identifies TWO chemicals added to water supplies with a justification for ONE.	1.5
Identifies ONE chemical WITH a justification	1

1. d i).

Marking criteria	*Marks*
Identifies one material *AND* one feature of the material.	1
Identifies one material. *Note – this question was poorly completed with very few students DESCRIBING the materials [The materials used for microfilters need to thin and strong, or flexible so they can be folded or pleated into the core etc….]*	0.5

1. d ii).

Marking criteria	*Marks*
Identifies ONE contaminant that can be removed with a filter.	1

1. e i)

Marking criteria	*Marks*
Identifies ONE heavy metal	1

1. e ii).

Marking criteria	*Marks*
Outlines TWO definitive tests for the heavy metal, one clearly indicated as qualitative and the other quantitative.	2
Outlines TWO definitive tests, one qualitative and one quantitative.	1.5
Outlines ONE test that is specific for the ion indicated in 1.ei)	1

2.

Marking criteria	*Marks*
Makes TWO comparisons of the composition of cationic and non-ionic detergents with two uses indicated for each.	3
Makes ONE comparison of composition and indicates ONE use of each type of detergent OR Describes TWO features of composition *AND* indicates TWO uses of each type of detergent OR Makes TWO comparisons of composition of the detergents	
Describes one use of each detergent [*A comparison shows how things are similar/different…e.g. Cationic detergents differ from non ionic detergents in the structure of their head. Cationic detergents have a head that has an overall positive charge, whereas non ionic detergents have an uncharged head……etc….* *Students who use a table to show similarities/differences MUST structure their tables so these are apparent – things that are being compared must be in the same position in each column etc….*]	1

3. a.

Marking criteria	*Marks*
0.5 marks for each correct piece of information [*note- Many students described a use of the battery by society rather than its impact on society. Likewise for impact on the environment. Also, equations need to be fully correct.*]	0.5 - 3

3. b.

Marking criteria	*Marks*
Outlines THREE criteria to consider ensure that the information is of value [** website is up-to-date* ** source is reputable and unbiased eg. .edu; .gov* ** information that is presented is consistent with information from other sources* ** information is relevant to the research question*]	2
Outlines TWO criteria to consider to ensure that the information is of value	1.5
Outlines ONE criterion to consider to ensure that the information is of value	1

4.

Marking criteria	*Marks*
Describes, thoroughly, TWO examples of the impact of soaps/detergents on the environment [** lower surface tension, making it impossible for water striders to walk across water. They sink instead and drown. This disrupts their lifecycle as well as impacting on whole ecosystems since they are a food source for higher order consumers.* ** phosphate builders that are added to detergents to enhance their cleaning power, promote the eutrophication of waterways……* ** some of the by-products of the biodegradation of detergents can mimic the action of hormones, disrupting breeding cycle of aquatic life……* ** in the time interval before soaps, detergents biodegrade, foaming of waterways may occur – unsightly; reduces the amount of oxygen that gets incorporated into water……..*]	3
Outlines TWO examples of the impact of soaps/detergents on the environment	2
Outlines ONE example of the impact of soaps/detergents on the environment	1

5.

Marking criteria	*Marks*
Calculates the maximum mass of copper (II) hydroxide precipitate that can form as 1.13 g AND Shows full and appropriate working for all steps of the calculation, including the determination of which reactant is present in limiting quantities AND Final answer is to 3 (or more) significant figures	3
Identifies the precipitate that forms [$Cu(OH)_2$] AND Calculates the initial number of moles of both solutions AND Presents a correct, balanced equation *OR* identifies the limiting reagent (for the equation that has been written)	2
Presents a correct, balanced equation OR Identifies the precipitate that forms OR Calculates the initial number of moles of both solutions	1

6.

Marking criteria	*Marks*
Presents THREE cause and effect relationships that explain how soaps/detergents solubilise oil and water [** the polar head of the soap molecule dissolves in polar water* ** the non-polar tail of the soap molecule dissolves in non-polar oil* ** the like-charged heads of the soap molecules that surround/coat oil droplets allow the oil droplets to remain suspended*]	3
Presents TWO cause and effect relationships	2
Presents ONE cause and effect relationship	1

7.

Marking criteria	*Marks*
Outlines the nature of scientific thinking **before** advances in our understanding of the chemistry of CFCs & the ozone layer had occurred [*CFCs were used because they were thought to be completely safe to use due to their lack of reactivity*] AND Outlines THREE advances in our understanding of the chemistry of CFCs and the ozone layer [** CFCs are NOT inert when they reach the stratosphere and are irradiated by UV radiation – highly reactive chlorine free radicals are released* ** chlorine free radicals react with ozone, depleting the amount of ozone in the ozone layer* ** ozone is essential for the health of living things since it absorbs UV light during its natural cycle of production and destruction*]	5
AND Outlines the nature of scientific thinking, including its chemistry, **after** advances in our understanding of the chemistry of CFCs & the ozone layer have occurred [*Alternative chemicals such as HFCs have been developed. HFCs perform the same role as CFCs but contain the more reactive C-H bond that means these chemicals break down readily in the troposphere. This means that they never reach the stratosphere to be acted on by UV radiation.*] AND Presents appropriate, balanced, relevant chemical equations	
Outlines the nature of scientific thinking **before** advances in our understanding of the chemistry of CFCs & the ozone layer had occurred AND Outlines TWO advances in our understanding of the chemistry of CFCs and the ozone layer AND Outlines the nature of scientific thinking **after** advances in our understanding of the chemistry of CFCs & the ozone layer have occurred AND Presents appropriate, balanced, relevant chemical equations	4

Outlines, using appropriate series of chemical equations, a thorough understanding of the chemistry of ozone destruction by CFCs OR Outlines a sound understanding of the chemistry of the chemistry of ozone destruction by CFCs *AND* outlines the chemistry of alternative chemicals such as HFCs that makes them safer (for society and the environment) OR Outlines the nature of scientific thinking before *AND* outlines a basic understanding of the effect of CFCs on the ozone layer *AND* identifies the current nature of scientific thinking	3
Outlines a basic understanding of the chemistry of ozone by CFCs AND/OR Identifies the alternative chemicals developed to replace CFCs	1 - 2