

Structure of this paper

| Section | Number of questions available | Number of questions to be answered | Suggested working time (minutes) | Marks available | Percentage of exam |
|-------------------------------------|-------------------------------|------------------------------------|----------------------------------|-----------------|--------------------|
| Section One: Multiple-choice | 20 | 20 | 30 | 20 | 20 |
| Section Two: Short response | 5 | 5 | 90 | 78 | 50 |
| Section Three: Extended response | 2 | 2 | 60 | 54 | 30 |
| Total | | | | | 100 |

Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2014*. Sitting this examination implies that you agree to abide by these rules.

- Answer the questions according to the following instructions.

Section One: Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two and Three: Write your answers in this Question/Answer Booklet.

- You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.
- The Formulae and Data Sheet is **not** to be handed in with your Question/Answer Booklet.

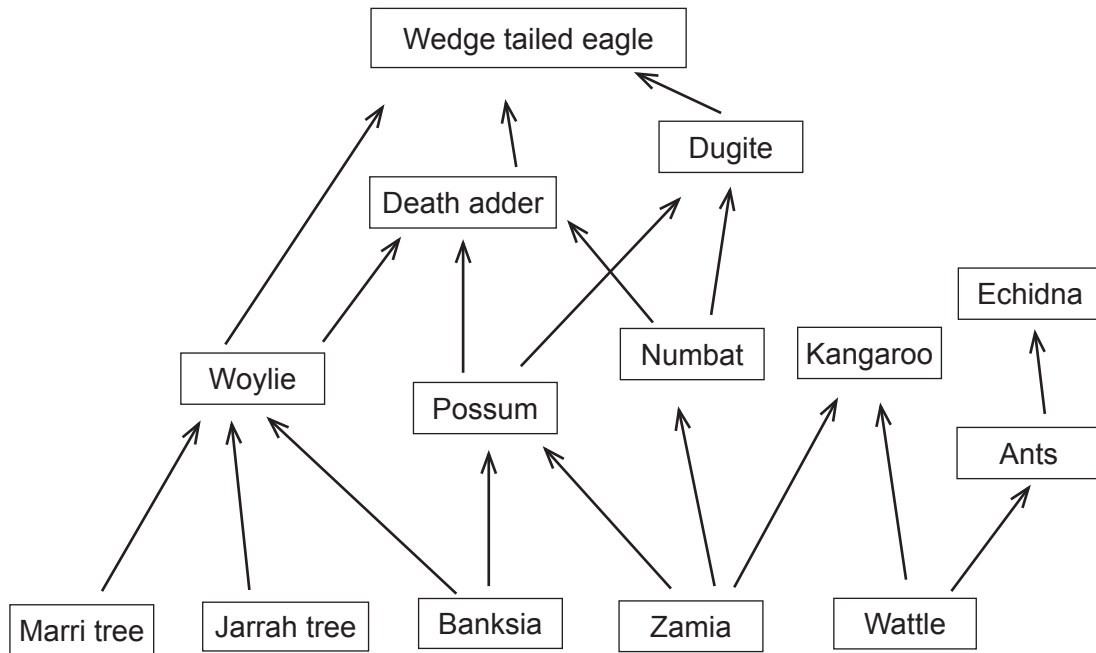
Section One: Multiple-choice

20% (20 Marks)

This section has **20** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 30 minutes.

Questions 1 and 2 refer to the diagram below that shows a typical jarrah forest food web.



1. Mining companies should prevent the transfer of plant diseases in infected soil to areas that are free from disease. If a plant disease infected and killed banksia trees in an area, which of the following impacts on the ecosystem could be expected?
 - i. decreased consumption of marri trees
 - ii. increased competition for jarrah and marri tree fruits
 - iii. reduced amount of food available for possums
 - iv. increased consumption of zamia plants
 - (a) i, ii, and iv
 - (b) ii, iii, and iv
 - (c) ii and iii
 - (d) i, ii, iii and iv

2. What do the arrows in the above diagram represent?
 - (a) The flow of energy from one trophic level to the next.
 - (b) They identify the predators in the ecosystem.
 - (c) The energy that is lost as matter is transferred from one trophic level to the next.
 - (d) The transfer of organic material from one feeding level to the next.

See next page

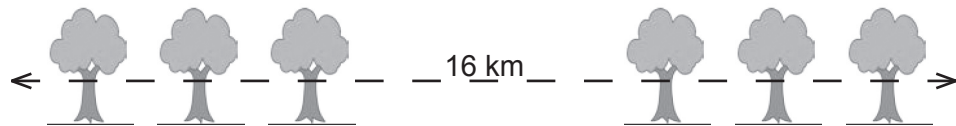
3. When iron and copper sulfides are exposed to air and water they form acidic compounds which can leach into water bodies. This is known as 'acid mine drainage'. Acid mine drainage has several environmental impacts. Which of the following is **most** likely?
- (a) Acidified waterways kill animals and plants and cause increased concentration of metals in waterways.
 - (b) The acidic water will react with limestone and cause an increase in carbon dioxide levels in the atmosphere, leading to an increase in global temperatures.
 - (c) The acidic water will run into the ocean and lead to the destruction of coral reefs.
 - (d) The increased acidity of waterways will lead to a decrease in oxygen solubility, leading to the death of fish.
4. When studying ecosystems ecologists use a range of survey techniques, including the use of a Harris trap, which is pictured below. The cage is a little larger than a loaf of bread and it is designed so that animals can enter but not leave. What survey method would use data obtained from a Harris trap?

For copyright reasons this image cannot be reproduced in the online version of this document, but may be viewed at www.amazon.com/Havahart-1079-Professional-Style-One-Door-Groundhog/dp/B00004RAMT/ref=sr_1_1?ie=UTF8&qid=1406083347&sr=8-1&keywords=havahart+1079+live+animal+professional+style+one+door+raccoon+groundhog+opossum+and+stray+cat+cage+trap

Harris trap

- (a) quadrat sampling
 - (b) transect sampling
 - (c) population density
 - (d) capture re-capture
5. Before mining an ore body that has been found in a particular location, the mining company must produce an environmental impact statement. The purpose of an environmental impact statement is to determine the
- (a) impact of mining operations on the animals and plants that live within the location.
 - (b) impact of mining operations on indigenous heritage sites, the diversity and populations of organisms, environmental pollution, and economy of the area.
 - (c) effect of pollution produced by mining in the area.
 - (d) impact of mining on the environment and describe ways in which it can be avoided or reduced.

6. Population density is
- a measurement of the population size of a species per unit area.
 - a measurement of the total population size of all the species found per unit area.
 - the number of individuals living in an ecosystem.
 - the number of different species living in a habitat.
7. Which one of the following equations shows the **overall** reaction that takes place in the blast furnace during the processing of iron ore (Fe_3O_4) to produce iron?
- $\text{Fe}_3\text{O}_4(\text{s}) + 2\text{C}(\text{s}) \rightarrow 3\text{Fe}(\ell) + 2\text{CO}_2(\text{g})$
 - $\text{Fe}_3\text{O}_4(\text{s}) + 4\text{C}(\text{s}) \rightarrow 3\text{Fe}(\ell) + 4\text{CO}(\text{g})$
 - $\text{Fe}_3\text{O}_4(\text{s}) + 2\text{C}(\text{s}) \rightarrow 3\text{Fe}(\ell) + 2\text{CO}(\text{g})$
 - $\text{Fe}_3\text{O}_4(\text{s}) + \text{C}(\text{s}) \rightarrow \text{Fe}(\ell) + \text{CO}_2(\text{g})$
8. Which one of the following describes the function of coke in a blast furnace?
- Produces heat when burnt in air.
 - Produces heat and carbon monoxide to reduce iron oxide to iron.
 - Reacts with oxygen to produce carbon dioxide to reduce iron oxide to iron.
 - When burnt in air, produces carbon dioxide which oxidises the iron oxide to produce iron.
9. Geologists have conducted a drilling program over a 16 km transect and recorded the results every four km by drilling to a depth of 600 m.



| Depth (m) | 0 km | 4 km | 8 km | 12 km | 16 km |
|-----------|-----------|-----------|-----------|---------|-----------|
| 100 | soil | soil | soil | soil | sandstone |
| 200 | sandstone | sandstone | soil | soil | slate |
| 300 | slate | slate | sandstone | slate | copper |
| 400 | copper | copper | slate | copper | granite |
| 500 | granite | granite | copper | granite | granite |
| 600 | granite | granite | granite | granite | granite |

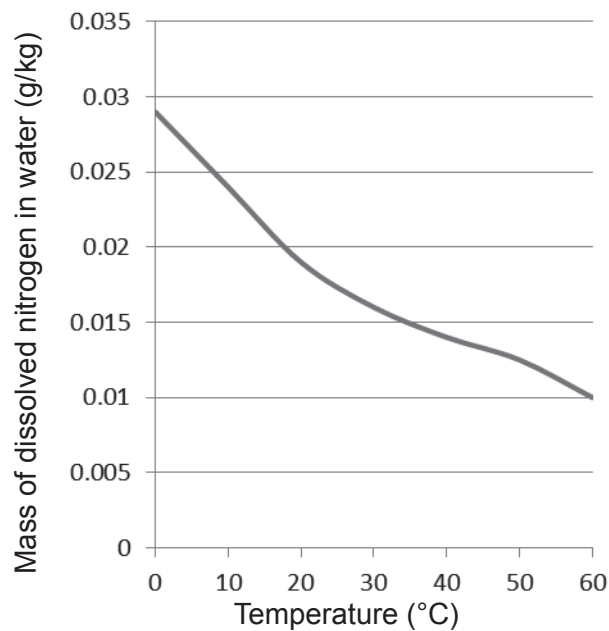
- Copper ore has been found within the profiles. Which type of mining technique would be chosen to mine the copper?
- quarrying – above ground mining
 - open-cut mining
 - strip mining
 - underground mining
10. Rutile, zircon and ilmenite are obtained from mineral sands. These three minerals are used to produce
- titanium dioxide, iron titanium oxide and zirconium silicate.
 - titanium dioxide, zinc oxide and zirconium silicate.
 - iron oxide and titanium oxide.
 - zirconium oxide, aluminium oxide and iron titanium oxide.

See next page

11. Scientific inquiry is based on the understanding that well-designed experiments will reveal information. This process involves holding certain variables constant while adjusting one variable to determine the effect on another variable. The variable that is adjusted is called the
- (a) independent variable.
 - (b) measured variable.
 - (c) controlled variable.
 - (d) dependent variable.
12. When evaluating the sustainability of energy sources, which of the following factors should be considered?
- (a) economic, technical, social
 - (b) social, economic, environmental
 - (c) technical, environmental, economic
 - (d) environmental, social, technical

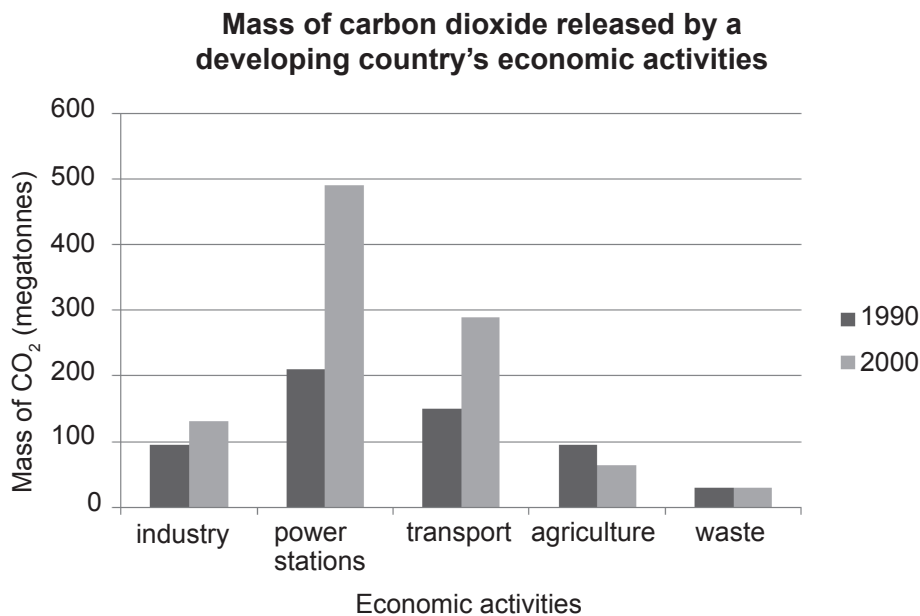
Question 13 refers to the graph below, which shows the maximum mass of nitrogen that can dissolve in one kilogram of water at different temperatures.

Solubility of nitrogen in 1 kg of water at different temperatures



13. Using the information in this graph, determine the mass of nitrogen gas that can dissolve in 10.0 kg of water at 25 °C.
- (a) 0.017 g
 - (b) 0.17 g
 - (c) 1.0 g
 - (d) 10.0 g

14. A Geiger counter is a device that detects radiation, and it can be used to detect radioactivity that is dangerous to humans. If a Geiger counter was housed in a cardboard box, which forms of radiation could it measure?
- alpha, beta and gamma
 - alpha and beta
 - beta and gamma
 - alpha and gamma
15. In a pressurised water reactor, what substance is typically used as the moderator?
- boron
 - water
 - neutrons
 - air
16. Radioactivity can be defined as the emission of
- radiation, as a result of the radioactive isotopes.
 - particles or radiation, as a result of the absorption of energy by atomic nuclei.
 - particles, as a result of the decay of stable isotopes.
 - radiation or particles, as a result of disintegrating unstable atomic nuclei.
17. Scientists recorded the mass of carbon dioxide (CO_2) that was released by a developing country in 1990 and again in 2000. During this time, the population of the country increased by 15%.



Using these data, what is the **most** likely explanation for the change in carbon dioxide emissions over the ten years it was studied?

- Increased use of electricity in homes and increased agricultural activity to feed the larger population.
- Development of more efficient power stations and the introduction of hydroelectricity.
- An increase in carbon dioxide emissions from power stations due to an expansion of industry.
- An increase in food production by increased agriculture combined with a more developed public transport system.

See next page

18. The purpose of bioleaching is to extract copper from ores such as chalcopyrite and chalcocite. Which statement **best** describes this process?
- (a) Cu^{2+} ions are produced when the bacteria oxidise the Cu^+ ions.
 - (b) The copper sulfide ores are dissolved in sulfuric acid and undergo electrolysis to produce pure copper metal.
 - (c) The insoluble sulfide minerals are oxidised by the bacteria and enter solution as copper ions and sulfate ions.
 - (d) The bacteria use oxygen to reduce the Cu^+ ions to Cu^{2+} ions which are insoluble and are deposited around air pipes that run through the bioleaching heaps.
19. Electricity is transmitted from a power station at higher voltages than are used in the home because it
- (a) uses fewer wires.
 - (b) travels faster.
 - (c) uses less insulation.
 - (d) reduces energy loss.
20. Which of the following fuels have used photosynthesis at some stage in their development to create the chemical energy stored in them?
- (a) oil, coal, geothermal
 - (b) natural gas, biomass, coal
 - (c) uranium, biomass, oil
 - (d) hydrogen gas, uranium, natural gas

End of Section One

See next page

Section Two: Short response

50% (78 Marks)

This section has **five (5)** questions. Answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

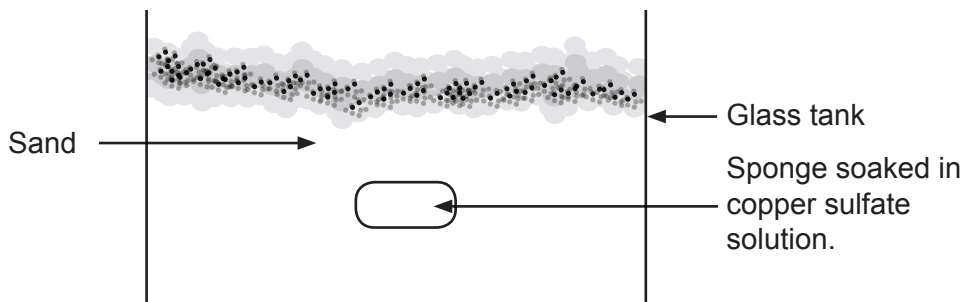
Question 21

(12 marks)

During mineral exploration, geochemists analyse soil, stream sediments and rock samples to determine the location of an ore body. Many ores are found in association with other substances which are called 'indicator substances'. Gold, for example, is often found with arsenic.

In order to help students understand this technique, Dr Esther made a model using an empty fish aquarium (labelled 'Glass tank' in the diagram). She placed a sponge soaked in copper sulfate solution on some clean sand at the front (inside the tank against the glass) of the aquarium before filling it with more sand.

The copper sulfate, which is a blue solution, spread slowly out into the sand, forming what is called a **primary dispersion halo** like the ones that form around real ore bodies. A primary dispersion halo is formed when hot water is forced through the cracks in rock, carrying dissolved substances from the ore into the surrounding rock.



- (a) As shown in the diagram above, what do each of the following components of the model represent? (3 marks)

Sponge: _____

Copper sulfate solution: _____

Sand: _____

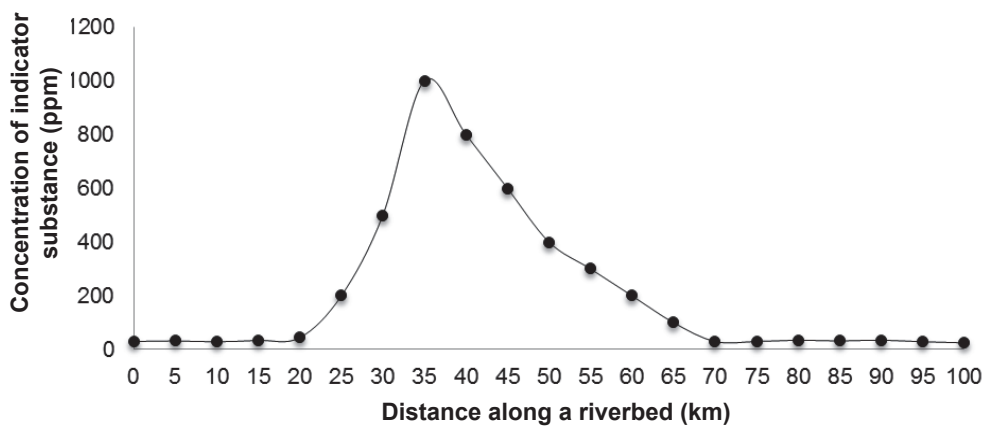
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Question 21 (continued)

- (b) If a geologist ordered a drill core to be taken and found a moderate level of indicator substance, why would he need to order more drilling? (2 marks)

- (c) The graph below shows the concentration of an indicator substance in stream sediment samples taken at distances along a riverbed. Indicate on the graph with a cross (x) where an ore body would most likely exist on the stream. (1 mark)

Concentration of indicator substance in stream sediment samples taken at distances along a riverbed



- (d) How could the depth of the water table affect the decision to proceed with the development of a mine? (2 marks)

- (e) Mining companies choose between surface and underground mining to extract ore from the ground.

- (i) Give **two** situations in which an underground mining technique might be used. (2 marks)

One: _____

Two: _____

- (ii) Give **two** situations in which open-cut mining might be used. (2 marks)

One: _____

Two: _____

Question 22

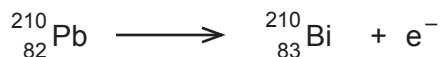
(25 marks)

Yasser Arafat was a former Palestinian President who smoked cigarettes. After eating dinner on October 12th, 2004, Arafat experienced nausea, vomiting and abdominal pain, which was followed by diarrhoea. These symptoms were present until about October 29th, 2004. Blood, urine and faecal matter tests could not identify any signs of recognised diseases, poisons, heavy metals or drugs that had not been prescribed by his doctors. Samples tested for substances producing gamma rays came back negative. Testing for the presence of alpha and beta emitting substances was not undertaken. He died on November 11th, 2004, almost one month after the onset of symptoms.

Poisoning by polonium-210 (Po-210), a radioactive material, was suggested as the cause of Arafat's death. With a half-life of 138 days, Po-210 decays, producing lead-206 (Pb-206) according to the following reaction:



Also, Pb-210 can undergo nuclear change to form Po-210. Some industrial use has been made of Pb-210, including older types of paint colour. Po-210 can be found naturally in the environment from the radioactive decay of uranium. It eventually forms Pb-210 which decays according to the following reactions, forming firstly bismuth and then polonium:



and the bismuth (Bi) undergoes the reaction



In 2013, an international television network commissioned further forensic testing to attempt to resolve the cause of Arafat's death. The following information is a summary of the observed facts identified in relation to potential Po-210 poisoning and the arguments for and against radiation poisoning in the report.

Question 22 (continued)

| Facts | Arguments against radiation poisoning | Arguments for radiation poisoning |
|--|--|---|
| Cause of symptoms could not be identified | <ul style="list-style-type: none"> • No hair loss • Bone marrow production was not reduced | <ul style="list-style-type: none"> • Symptoms associated with digestive processes (nausea, vomiting, diarrhoea) appeared after eating • Death occurred one month after symptoms appeared • Hair loss and reduced bone marrow production are typically associated with external radiation exposure, but are not always associated with radiation exposure from ingestion (eating and drinking) • Tests for poisons, drugs and diseases were negative |
| Po-210 was detected in stains from body fluids on personal belongings and in the body when it was examined in 2013 | <ul style="list-style-type: none"> • Origin of the Po-210 could be from cigarette smoke • The amount of Po-210 could be explained by the decay of Pb-210 | There is too much Po-210 detected in stains to be derived from only the decay of Pb-210, from smoking or a combination of lead poisoning and smoking |
| Levels of Pb-210 in the body were higher than normal population reference levels and Pb-206 was found in a rib | Lead poisoning could not be ruled out due to findings | <ul style="list-style-type: none"> • Long term exposure to lead could not be identified • Po-210 made from nuclear reactors contains Pb-210 • Po-210 decays into Pb-206 • Lower levels of the isotope Pb-207 was found than would be expected if the Po-210 was a decay product of Pb-210 |

(a) List **three** symptoms a person might experience due to high exposure to radiation. (3 marks)

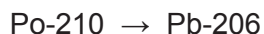
One: _____

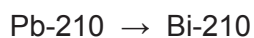
Two: _____

Three: _____

- (b) What did the researchers investigating Yasser Arafat's death look for when trying to determine if Po-210 was present in his body at the time of his death? (2 marks)

- (c) What types of radiation are emitted in the following equations? (2 marks)





- (d) (i) On the basis of the information in the text, what is the most likely way in which Yasser Arafat might have been exposed to radiation? (1 mark)

- (ii) Provide **one** piece of evidence to support your answer. (1 mark)

- (e) On the basis of the information in the text, provide **two** possible explanations for the presence of Po-210 in Arafat's body, other than from radiation poisoning. (2 marks)

One: _____

Two: _____

Question 22 (continued)

- (f) If 3036 days had passed between the date of possible exposure to Po-210 and when the forensic testing of the body occurred, calculate how many half-lives had passed. Show **all** workings. (3 marks)

- (g) Explain the difference between 'nuclear fission' and 'nuclear fusion'. (2 marks)

- (h) List **two** precautions people working at a nuclear reactor site might take to safely handle nuclear materials. (2 marks)

One: _____

Two: _____

(i) Ted Ringwood from the Australian National University, developed 'Synroc' in 1978. It is one approach used for geological storage of nuclear waste. Synroc is still produced by the Australian Nuclear Science and Technology Organisation (ANSTO).

(i) In 2014, new research was conducted to investigate the use of blast furnace slag instead of Synroc for storing nuclear waste. List **three** reasons why blast furnace slag might be chosen as an alternative to Synroc. (3 marks)

One: _____

Two: _____

Three: _____

(ii) State **two** reasons why methods of storage such as Synroc are desirable for storing radioactive waste. (2 marks)

One: _____

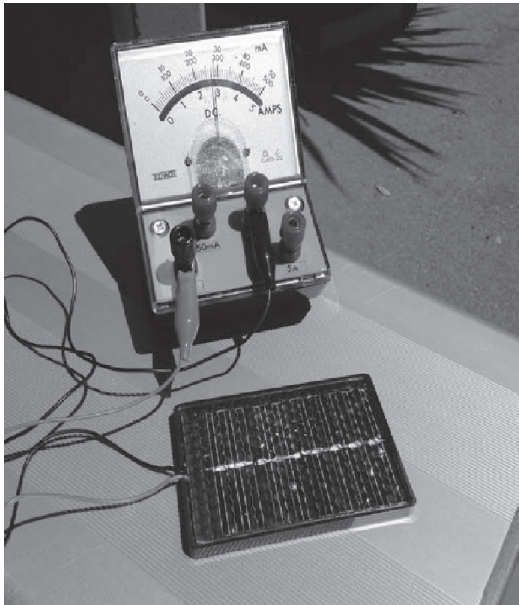
Two: _____

(j) What is meant by the term 'geological storage' as it applies to nuclear waste? (2 marks)

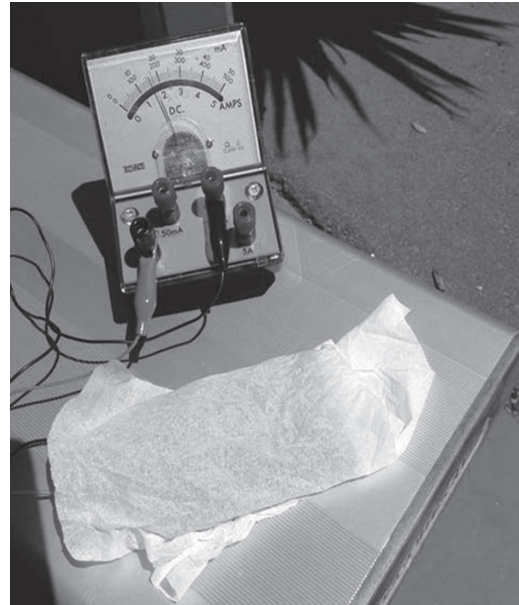
Question 23

(21 marks)

On a trip to England, Harry and Oliver noticed that there were more homes with solar panels on the roofs than there were when they last visited four years ago. Their own home in Perth has solar panels that produce electricity. They could not understand why solar panels were being used in England, when sunny days were not as common as in Western Australia. They decided to carry out an investigation to determine the effect of cloud cover on the amount of current produced by a solar cell. To do this they used a solar cell connected to an ammeter, which measured the current, and layers of tissue sheets to represent the cloud cover. The photographs below show the experiment setup.



Solar cell in sunlight with no covering



Solar cell in sunlight with covering

The table below shows the data they collected after the solar cell was placed in sunlight. An increasing number of tissue sheets were laid over the solar cell for 20 s and the maximum current was recorded.

| Number of tissue sheets covering the solar cell | Trial 1 (mA) | Trial 2 (mA) | Trial 3 (mA) | Average current (mA) |
|---|--------------|--------------|--------------|----------------------|
| 0 | 280 | 290 | 285 | 285 |
| 1 | 190 | 195 | 190 | 192 |
| 2 | 140 | 145 | 142 | 142 |
| 3 | 110 | 90 | 115 | 113 |
| 4 | 75 | 70 | 70 | 72 |
| 5 | 60 | 62 | 65 | 62 |
| 6 | 55 | 55 | 55 | 55 |
| 7 | 50 | 55 | 55 | 53 |
| 8 | 45 | 40 | 42 | 42 |
| 9 | 40 | 35 | 42 | 39 |
| 10 | 40 | 32 | 38 | 37 |
| 11 | 35 | 32 | 29 | 32 |
| 12 | 35 | 32 | 32 | 33 |

See next page

- (a) Identify the dependent variable. (1 mark)

- (b) Identify the independent variable. (1 mark)

- (c) Examine each set of data (i.e. Trial 1, Trial 2 and Trial 3) for the different number of tissue sheets. Which set of data has a value that is an anomalous result (an outlier)? (1 mark)

- (d) Provide **one** explanation that might suggest what caused the result in part (c). (1 mark)

- (e) (i) What **two** pieces of information do you need in order to calculate the power of a solar cell? (2 marks)

One: _____

Two: _____

Question 23(e) (continued)

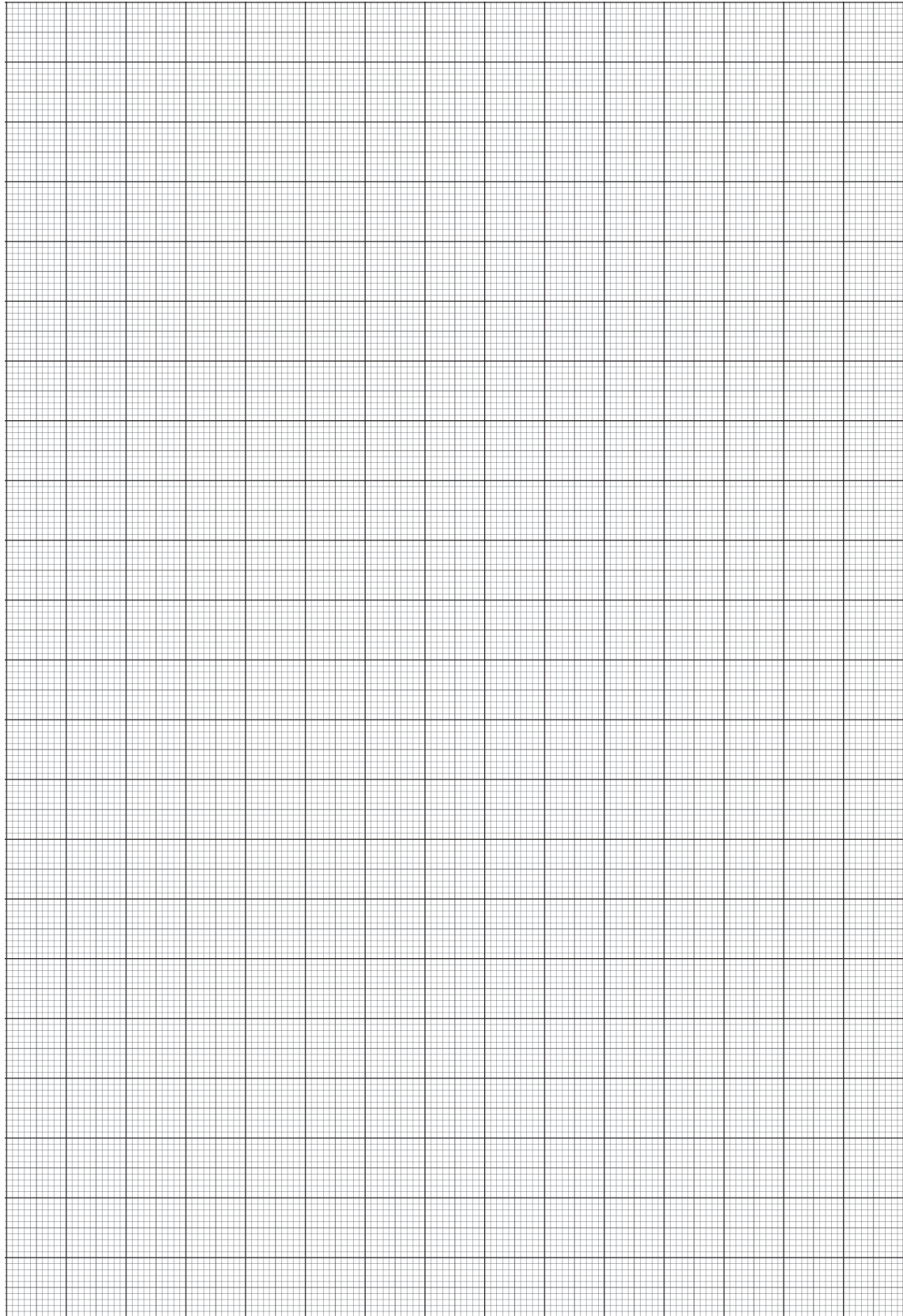
- (ii) Complete the table below by calculating the power produced by the solar panel for different numbers of tissue sheets based on the average current (mA). The solar cell is rated at 6.0 V. Show your workings for **one** answer in the box below the table. (5 marks)

The average current and power output for different numbers of tissue sheets covering a solar cell

| Number of tissue sheets covering the solar cell | Average current (mA) | Power (mW) |
|---|----------------------|------------|
| 0 | 285 | 1710 |
| 1 | 192 | |
| 2 | 142 | 854 |
| 3 | 113 | 675 |
| 4 | 72 | |
| 5 | 62 | 374 |
| 6 | 55 | 330 |
| 7 | 53 | |
| 8 | 42 | 254 |
| 9 | 39 | 234 |
| 10 | 37 | 220 |
| 11 | 32 | |
| 12 | 33 | 198 |

- (f) On the grid below, graph the number of tissue sheets against the power output (mW) produced by the solar cell, on the basis of the results table on page 18. (5 marks)

(If you need to have a second attempt at this graph item, the grid is repeated on the last page of the Question/Answer Booklet. Cancel the workings on this page.)



Question 23 (continued)

- (g) What **three** conclusions can be drawn from the graph of results about the effect of cloud cover on the electrical current produced by solar panels? (3 marks)

One: _____

Two: _____

Three: _____

- (h) On the basis of the results of the experiment, calculate the number of solar panels that would be needed in a very cloudy location, such as England, to achieve the same output as a panel in a cloud-free location. Show **all** workings. (2 marks)

Question 24

(10 marks)

Science usually underpins the collection of data used to identify and assess the impact of new mine sites. These are reported in environmental impact statements, such as Public Environmental Review (PER) documents. The aspects addressed in a PER might include:

- air quality investigations and modelling
- soil, geology and geochemistry investigations
- noise and vibration studies and modelling
- water quality investigations and modelling
- hydrology and groundwater investigations and modelling
- flora and fauna investigations
- indigenous and non-indigenous cultural heritage investigations.

(a) (i) Select **four** of these aspects and for each describe how the data could be gathered. (4 marks)

One: _____

Two: _____

Three: _____

Four: _____

(ii) Why are these data collected and how are they used? (2 marks)

Question 24 (continued)

During the preparation of a PER for its new mine site, Mocea Resources is also planning to conduct a range of community consultation activities. In a meeting to plan the consultation activities, Amy, the human resources manager, suggested that in the modern world this might best be achieved by calling people on their mobile phones. She indicated that phoning five per cent of the population of a local town would be appropriate.

- (b) Identify **two** limitations of this sampling technique. (2 marks)

One: _____

Two: _____

- (c) If you were the community consultation manager, identify **two** appropriate methods you would use for collecting consultation data for the PER. (2 marks)

One: _____

Two: _____

Question 25

(10 marks)

Geophysical survey techniques can be used to identify potential ore bodies as part of mineral exploration activities.

- (a) Name the piece of equipment used to conduct gravity surveys. (1 mark)

- (b) (i) How are aerial gravity surveys conducted? (1 mark)

- (ii) What data is collected? (1 mark)

- (iii) Explain how the data is used to identify potential ore bodies. (2 marks)

- (c) List **two** advantages of aerial gravity survey techniques. (2 marks)

One: _____

Two: _____

- (d) Give **one** reason why potential mine sites can be identified using these techniques. (1 mark)

- (e) Magnetic surveys are also used during mineral exploration. Which types of ore bodies could be located using magnetic surveys? Provide an example of a mineral that can be located using magnetic surveys. (2 marks)

End of Section Two

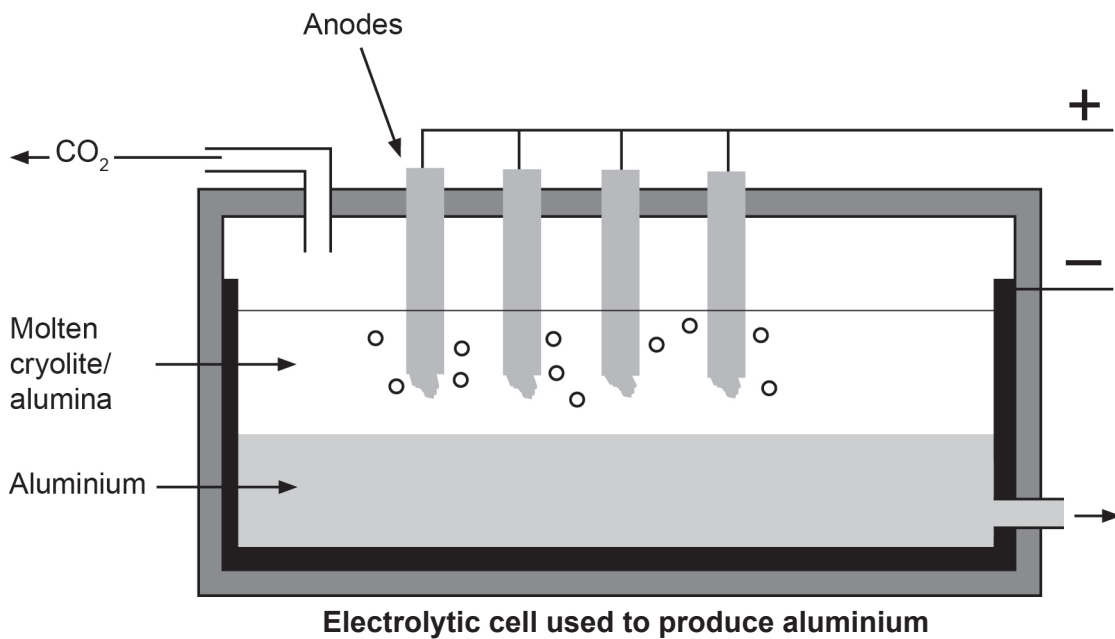
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(b) The Bayer process is used to remove impurities from bauxite to produce a white powder called alumina (aluminium oxide). There are four main steps in this process. Write the name of each of these and describe each process. (8 marks)

| Name of process | Description |
|----------------------|-------------------------|
| Step one: <hr/> | <hr/> <hr/> <hr/> <hr/> |
| Step two: <hr/> | <hr/> <hr/> <hr/> <hr/> |
| Step three: <hr/> | <hr/> <hr/> <hr/> <hr/> |
| Step four: <hr/> | <hr/> <hr/> <hr/> <hr/> |

Question 26 (continued)

The diagram below shows a typical electrolytic cell used to produce aluminium metal from alumina in the Hall-Hérout process.



- (c) List **two** reasons why cryolite is added to the alumina in this process. (2 marks)

One: _____

Two: _____

- (d) Explain why the anodes need to be replaced regularly. (2 marks)

- (e) The table below shows the sequence of steps taken to rehabilitate a bauxite mine. Complete the table by providing **one** reason that explains the purpose of each of these steps. (5 marks)

| Step | Purpose |
|---|-------------------|
| Remove the top soil from the area to be mined and store it. | <hr/> <hr/> <hr/> |
| Replace overburden and contour landscape. | <hr/> <hr/> <hr/> |
| Place rocks and timbers on the land. | <hr/> <hr/> <hr/> |
| Cultivate seedlings in the nursery and replant. | <hr/> <hr/> <hr/> |
| Provide nest boxes for wildlife. | <hr/> <hr/> <hr/> |

Question 27

(29 marks)

In Australia, all newly built residential homes must meet energy efficiency standards described in the Building Code of Australia (BCA). This includes the rating of the energy efficiency using star ratings, similar to the star rating labels on certain appliances, such as whitegoods. Since 2010, all new homes must be designed to a six star rating standard. The most energy efficient homes in Australia can be awarded up to ten stars. Most homes in Perth built before changes to the BCA would be rated at two or three stars. The home energy rating does not consider the efficiency of any appliances fitted or used within the home.

A six star rating indicates that a building achieves a high level of heat energy performance, and will require minimum levels of heating and cooling to be comfortable in winter and summer. Homes that achieve a six star rating, compared to the average two star home, should be more comfortable to live in, have lower energy bills, and costs to install heating and cooling equipment should also be lower.

- (a) List **two** design features you would expect to see in a home that has achieved a six star rating. (2 marks)

One: _____

Two: _____

- (b) For each of your answers in part (a), explain how heat energy transfers are controlled to reduce the energy consumed by the home. (4 marks)

One: _____

Two: _____

- (c) Design features are only one aspect that influence the amount of energy consumed in homes. Identify and explain **three** other factors that affect the amount of energy used. (6 marks)

One: _____

Two: _____

Three: _____

See next page

- (d) In recent years, many families have installed solar panels as a way of reducing their electricity bills. What effect would installing solar panels on your roof have on your total energy consumption if no other changes were made to your home? (1 mark)

The South West Interconnected System (SWIS) consists of almost 88 000 km of power lines supplying electricity to homes and businesses in the south-west of the state between Kalbarri, Kalgoorlie and Albany. While most of the electricity on the SWIS is generated by coal or natural gas-fired power stations, approximately five per cent comes from renewable energy resources, such as wind energy.



- (e) Use a flow diagram to show how a coal fired power station produces electricity, identifying the energy transformations that occur at each stage. (6 marks)

Question 27 (continued)

- (f) Identify and explain **two** advantages and **two** disadvantages of using coal to produce electricity compared to using a renewable resource you have studied. (5 marks)

Renewable resource: _____

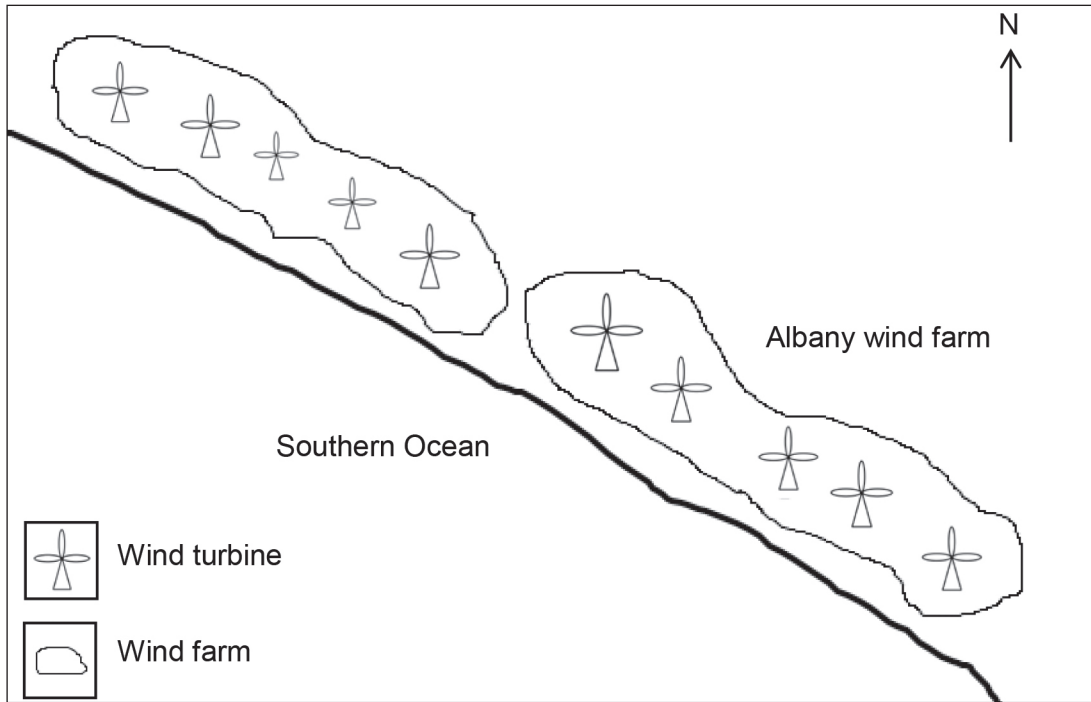
Advantage one: _____

Advantage two: _____

Disadvantage one: _____

Disadvantage two: _____

In the city of Albany, which lies on the southern coast of Western Australia facing the Southern Ocean, a wind farm has been constructed. The wind farm is now providing renewable energy to Albany and its 15 000 homes. It is predicted that the eighteen 65 m high wind turbines with 35 m long blades will save about 1.5 million tonnes of greenhouse gas emissions in 20 years of operation. The figure below shows the location of the Albany wind farm.



(g) Explain how electricity is generated by a wind turbine. (3 marks)

(h) What factor is likely to affect how much energy a wind turbine at Albany produces? (1 mark)

(i) Suggest **one** reason why the wind farm was built at Albany and not inland at Kalgoorlie. (1 mark)

Spare grid.



ACKNOWLEDGEMENTS

Section One

- Question 4** *Harris trap* [Image]. (n.d.). Retrieved from www.amazon.com/Havahart-1079-Professional-Style-One-Door-Groundhog/dp/B00004RAMT/ref=sr_1_1?ie=UTF8&qid=1406083347&sr=8-1&keywords=havahart+1079+live+animal+professional-style+one-door+raccoon+groundhog+opossum+and+stray+cat+cage+trap

Section Two

- Question 22** Information from: Mangin, P., Bochud, F., Augsburg, M., Baechler, S., Bailat, C. Castella, V., Froidevaux, P., Michaud, K., ... & Uldin, T. (2013, November 5). *Expert forensic report concerning the late President Yasser Arafat*. Lousanne, Switzerland: Centre hospitalier universitaire vaudois. Retrieved March 20, 2014, from www.documentcloud.org/documents/815515-expert-forensics-report-concerning-the-late.html#document/p63
- Question 23** Images of ammeter by courtesy member of the examining panel.

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