Government of **Western Australia**
School Curriculum and Standards Authority

SAMPLE ASSESSMENT TASKS

INTEGRATED SCIENCE
ATAR YEAR 12

Sample assessment task

Integrated Science – ATAR Year 12

Task 3 – Unit 3

Assessment type: Science inquiry

Conditions
Period allowed for completion of the task: three weeks

Task weighting
8% of the school mark for this pair of units

Science inquiry (investigation) – Comparison of two local aquatic ecosystems (51 marks)

Biodiversity is the variety of all life forms. The types and number of species of organisms can be an indicator of the health of an ecosystem.

Design and carry out a field study on the effects of human impact on **two** aquatic ecosystems. The human impacts link to the difference in abiotic and biotic factors and, as a consequence, the biodiversity of each ecosystem. You are to present your findings as a scientific report.

What you need to do

Plan the investigation
- Choose two aquatic ecosystems to study. One of these should be in an area that has not been disturbed greatly by human activity and the other should have significant development in the surrounding area or catchment.
- Research the history of the ecosystems to gauge the impact of development on the biodiversity of the ecosystem.
- Research measurement methods and tolerance limits for the following abiotic factors: temperature, turbidity, pH, dissolved oxygen concentration, nitrate levels and phosphate levels.
- Make a preliminary visit to the ecosystems (if possible).
- Research sampling methods that can be used for biotic factors in the aquatic ecosystem.
- Order the necessary equipment required for the sampling methods, as directed by your teacher.
- Discuss other types of evidence that may be collected.
- Prepare tables to record observations and the results of tests carried out.

Conduct the investigation
- Record a description of the ecosystems being investigated.
- Survey the area surrounding the aquatic ecosystem.
- Collect data on the physical or abiotic factors of each ecosystem.
- Use sampling methods to measure organisms in the aquatic ecosystem.

Process, evaluate and communicate findings in the form of a scientific report.

Your report should include the following;

- Introduction – provide a brief description of each ecosystem. Discuss the land use surrounding the aquatic ecosystems and its effect on the biodiversity of the ecosystems. (4 marks)
- Materials – outline the equipment used. (2 marks)
- Method – describe the method used for the gathering of data. Include a map or photograph of each aquatic ecosystem. (4 marks)
- Results – collate results for physical measurements and other qualitative observations. Represent the data using the most suitable format. (5 marks)
- Discussion – analyse the results by identifying trends in the data, and relating the trends to the history and use of the land surrounding the aquatic ecosystems. Include in your discussion list the acceptable tolerance limits for **four** abiotic factors and discuss how a change in these limits affects the living organisms in each ecosystem. Discuss the reliability of your data. (26 marks)
- Conclusion – summarise the findings and compare the biodiversity of the two aquatic ecosystems. Suggest possible management plans for the two ecosystems. (10 marks)

Resources

http://en.wikibooks.org/wiki/IB_Environmental_Systems_and_Societies/Measuring_abiotic_components_of_the_system

www.dec.wa.gov.au

Marking key for sample assessment task 3 – Unit 3

Introduction – provide a brief description of each ecosystem. Discuss the land use surrounding the aquatic ecosystems and its effect on the biodiversity of the ecosystems.

Description	Marks
Provides a brief description of each ecosystem	1
Lists or states human activity surrounding both ecosystems	1
Discusses the effect of land use on biodiversity at each ecosystem	1–2
Total	**/4**

Materials – outline the equipment used.

Description	Marks
Provides a comprehensive list of materials OR Most materials included	2 1
Total	**/2**

Method – describe the method used for the gathering of data. Include a map or photograph of each aquatic ecosystem.

Description	Marks
Procedure is clearly outlined in steps that can be followed OR Procedure is brief but includes relevant aspects	2 1
Map or photograph included for each ecosystem	2
Total	**/4**

Results – collate results for physical measurements and other qualitative observations. Represent the data using the most suitable format.

Description	Marks
Data from the excursion is presented in well-organised table/s OR Some data omitted from the table	2 1
Appropriate titles used on table/s	1
Appropriate headings used on table/s	1
Averages calculated and included in table/s	1
Total	**/5**

Discussion – analyse the results by identifying trends in the data, and relating the trends to the history and use of the land surrounding the aquatic ecosystems. Include in your discussion list the acceptable tolerance limits for **four** abiotic factors and discuss how a change in these limits affects the living organisms in each ecosystem. Discuss the reliability of your data.

Description	Marks
Identifies trends in the abiotic data	1–2
Identifies trends in the biotic factors	1–2
Compares the effects of biotic and abiotic factors on each ecosystem	1–2
Supports data with discussion of the history of human activities that brought about the difference; for instance, catchment land use and the abiotic measurements recorded	1–2
Discusses the effects of the degradation on each aquatic ecosystem	1–2
Relates the presence of particular organisms to the condition of the surrounding area and compares the effects of biotic and abiotic factors on the ecosystem; for instance, algal blooms indicate a high presence of nitrates and phosphates	1–2
Identifies the biodiversity of the ecosystem as a consequence of the biotic factors living in the ecosystem	1–2
Lists the acceptable tolerance limits for each abiotic factor	1–4
Discusses how a change in these limits affects organisms living in them	1–4
Suggests ways in which the collection of data could be improved	1
Accounts for anomalous results	1
Comments on the accuracy of the results for abiotic factors	1
Comments on the accuracy of the results for biotic factors	1
Total	**/26**

Answer could include, but is not limited to:

Acceptable tolerance limits and description of the effects of abiotic factors

- aquatic organisms prefer temperatures of between 15 ^{o}C and 25 ^{o}C (fish can survive in warmer water, but only for short periods of time)
- higher temperature can lower dissolved oxygen concentration

AND/OR

- turbidity – increased turbidity can reduce the amount of available light for photosynthetic organisms
- increased turbidity can reduce aquatic plant growth which, in turn, affects food availability and oxygen concentration. The suspended particles can also help transport pesticides and heavy metals

AND/OR

- pH – the normal range of pH values in a freshwater system is between 6.0 and 9.0
- lower pH values can result from an increase in carbon dioxide levels which, in turn, can affect the enzyme action of aquatic organisms, leading to death

AND/OR

- dissolved oxygen concentration – is measured in units of mg/L. The ideal range for stream fish is 7–11 mg/L
- most organisms require oxygen for survival, so lower oxygen levels caused by increased water temperatures or an increase in the number of organisms can be lethal

AND/OR

- nitrate levels are usually less than 1 mg/L (concentrations over 10 mg/L will have an effect on any freshwater environment)
- increased nitrate levels can lead to significant plant growth called algal blooms (initially, the blooms produce greater quantities of dissolved oxygen; however, when they die, much more oxygen is consumed by the decomposers, leaving little oxygen available for other aquatic organisms)

AND/OR

- large streams have levels of phosphates around 0.1 mg/L while small streams have levels of only 0.01 mg/L
- increased phosphate levels lead to algal blooms

Conclusion – summarise the findings and compare the biodiversity of the two aquatic ecosystems. Suggest possible management plans for the two ecosystems.

Description	Marks
Provides a summary of the findings at each ecosystem	1–2
Identifies the biodiversity of the ecosystem as a consequence of the biotic factors living in that ecosystem	1–2
Links the differences in biodiversity to the difference in abiotic factors	1–2
Discusses consequences of land use on the biodiversity of each ecosystem	1–2
Makes suggestions for future management for each ecosystem	1–2
Total	**10**

Sample assessment task

Integrated Science – ATAR Year 12

Task 5 – Unit 3

Assessment type: Extended response

Conditions
Time for the task:
Research and preparation – one week
Extended response – 50 minutes

Task weighting
2% of the school mark for this pair of units

Extended response – Water treatment **(23 marks)**

After viewing the following sources, you will be asked to use your understanding of science concepts to answer a number of questions. You may have annotated copies of the articles with you during the in-class validation. You may also bring in a single-sided page of A4 notes from the videos.

Read or view the following sources:

The brochures on the Subiaco waste treatment plant and the Woodman Point wastewater treatment plant
http://www.watercorporation.com.au/water-supply-and-services/wastewater/our-wastewater-treatment-plants

Desalination in WA – how it works
http://www.watercorporation.com.au/water-supply-and-services/solutions-to-perths-water-supply/desalination

Recycled drinking water: what Australians need to know (Hagare, 2012)
http://theconversation.com/recycled-drinking-water-what-australians-need-to-know-7216

Namibia's drinkable sewage
http://www.abc.net.au/correspondents/content/2010/s3027870.htm

Waste water treatment: Sewage to Drinking water in 10-minutes
https://www.youtube.com/watch?v=49otYP9nnkQ

Extended response – Water treatment **(23 marks)**

Validation questions

1. The Subiaco wastewater treatment plant was built in 1927. It consisted of two septic tanks. Describe the **four** main steps involved in the treatment of sewage by septic tanks at the plant in 1927. (4 marks)

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2. Discuss **two** environmental concerns related to the operation of the Subiaco wastewater treatment plant in 1927. (2 marks)

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3. In the space provided, create a flow diagram for the Subiaco wastewater treatment plant. (6 marks)

4. The Woodman Point wastewater treatment plant was constructed in 1983. Identify **two** by-products that are produced at the Woodman Point wastewater plant that are not produced at the Subiaco wastewater treatment plant. (2 marks)

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5. Give **two** reasons for the development of the desalination plants in Western Australia. (2 marks)

_____

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6. Name and describe the process by which the Kwinana desalination plant produces drinkable water. (4 marks)

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7. Outline **three** reasons why treated sewage should be used as drinking water in Namibia. (3 marks)

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Marking key for sample assessment task 5 – Unit 3

1. The Subiaco wastewater treatment plant was built in 1927. It consisted of two septic tanks. Describe the **four** main steps involved in the treatment of sewage by septic tanks at the plant in 1927.

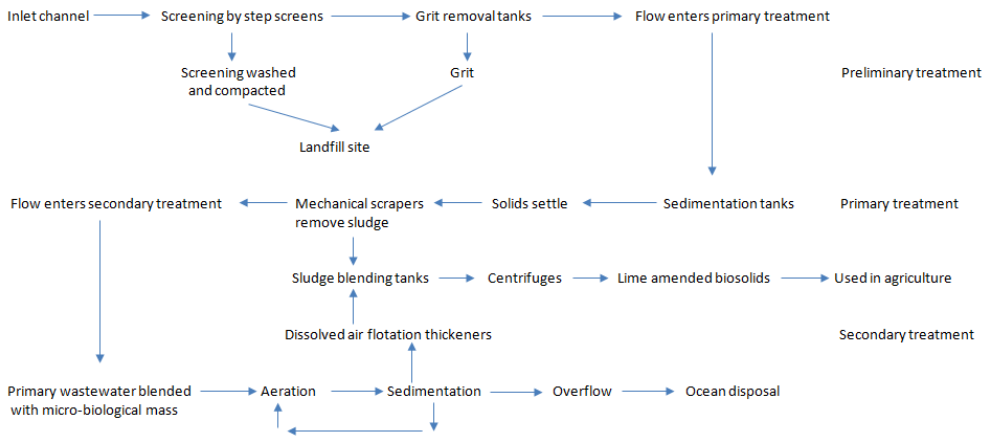
Description	Marks
Grey water from houses would flow into the septic tanks	1
Solids settle to the bottom of the tanks and undergo bacterial digestion to produce sludge, which can then be removed and disposed of	1
Lighter solids, such as oil and grease, float to the surface, which can then be removed and disposed of	1
Remaining effluent was treated and then released into the ocean 100 metres offshore	1
Total	**/4**

2. Discuss **two** environmental concerns related to the operation of the Subiaco wastewater treatment plant in 1927.

Description	Marks
Any two environmental concerns discussed	1–2
Total	**/2**
Answer could include, but is not limited to:	
• the effluent would have been high in nutrients which could affect the aquatic ecosystem • the effluent could have caused algal blooms/eutrophication • the effluent was discharged only 100 metres offshore so the effluent could have washed onto the beaches	

3. In the space provided, create a flow diagram for the Subiaco wastewater treatment plant.

Description	Marks
Preliminary treatment • screening, with wastes going to landfill • grit removal, with wastes going to landfill	 1 1
Primary treatment • sedimentation • sludge blending	 1 1
Secondary treatment • addition of micro-biological mass, with waste products entering the ocean • centrifuges, with waste products being used in agriculture	 1 1
Total	**/6**
Answer could include, but is not limited to:	



4. The Woodman Point wastewater treatment plant was constructed in 1983. Identify **two** by-products that are produced at the Woodman Point wastewater plant that are not produced at the Subiaco wastewater treatment plant.

Description	Marks
Industrial grade water/for use by local industries	1
Biogas (methane) production/used for on-site electricity production	1
Total	**/2**

5. Give **two** reasons for the development of the desalination plants in Western Australia.

Description	Marks
Climate is becoming drier	1
Increase in population	1
Total	**/2**

6. Name and describe the process by which the Kwinana desalination plant produces drinkable water.

Description	Marks
Reverse osmosis	1
Three points required in the description	1–3
Total	**/4**
Answer could include, but is not limited to:	
• sea water is pressurised • passes through a pre-treatment filter to remove large particles • forced, under pressure, through spiral-wound membranes • water is treated with lime, chloride and fluoride • blended with water from other sources	

7. Outline **three** reasons why treated sewage should be used as drinking water in Namibia.

Description	Marks
Three reasons outlined	1–3
Total	**/3**
Answer could include, but is not limited to:	
• limited water available in Namibia • increase in population placed a greater demand on water supplies • too costly to use the rivers in the north and south of the country • safe to drink	

Sample assessment task

Integrated Science – ATAR Year 12

Task 12 – Unit 4

Assessment type: Test

Conditions
Time for the task: 55 minutes

Task weighting
5% of the school mark for this pair of units

Test: Electricity **(66 marks)**

Section One: Multiple-choice **(10 marks)**

This section has **10** 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.

1. For a chain reaction to continue in a pressurised water nuclear reactor, a minimum of one neutron from each fission reaction must produce another fission reaction. The **best** description of the role of control rods in this process is that they

   (a) absorb neutrons produced by the fission reaction.
   (b) control the speed of the neutrons so that the reaction can continue.
   (c) determine the amount of heat that can be absorbed by the coolant.
   (d) control the depth of the fuel rods, which changes the rate of the chain reaction.

2. 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?

   (a) alpha, beta and gamma
   (b) alpha and beta
   (c) beta and gamma
   (d) alpha and gamma

3. Radioactivity can be defined as the emission of

   (a) radiation, as a result of the radioactive isotopes.
   (b) particles or radiation, as a result of the absorption of energy by atomic nuclei.
   (c) particles, as a result of the decay of stable isotopes.
   (d) radiation or particles, as a result of disintegrating, unstable atomic nuclei.

4. Electricity is transmitted from a power station at higher voltages than the 240 volts used in the home because it

   (a) uses fewer wires.
   (b) travels faster.
   (c) uses less insulation.
   (d) reduces energy loss.

5. The rate of flow of charged particles through a conductor is called

   (a) current.
   (b) voltage.
   (c) resistance.
   (d) power.

6. An air conditioner carries the following label

   240 volt
   2880 watt

   If you were to operate this air conditioner for eight hours, what would be the cost of the electricity, if it is purchased at 32 cents per kilowatt-hour?

   (a) $7372.00
   (b) 92.18 cents
   (c) $14.12
   (d) $7.37

7. The negative electrode of a dry cell is made up of

   (a) copper.
   (b) zinc.
   (c) lead.
   (d) carbon.

8. Photovoltaic cells create electricity when particles from sunlight strike the surface of the cell. These particles are

   (a) electrons.
   (b) neutrons.
   (c) photons.
   (d) protons.

9. Generators work on the principle of electromagnetic induction. Electromagnetic induction involves the creation of

   (a) an electric field.
   (b) a magnetic field.
   (c) electrons.
   (d) protons.

10. In 2009, the sale of traditional, pear-shaped incandescent light bulbs was phased out because they were not efficient. Which statement is true about energy efficient light bulbs?

    Energy efficient light bulbs release

    (a) less light energy and less heat energy than incandescent light bulbs.
    (b) less light energy and more heat energy than incandescent light bulbs.
    (c) more light energy and less heat energy than incandescent light bulbs.
    (d) less light energy and more heat energy than incandescent light bulbs.

End of Section One

Section Two: Short response **(56 marks)**

This section has **three** questions. Answer all questions. Write your answers in the spaces provided.

Question 11 **(18 marks)**

Fukushima, Japan is the location of a former nuclear power station that was badly damaged by a tsunami in 2011. Fukushima has been contaminated by radioactive materials.

(a) Explain what is meant by the term 'radioactive'. (4 marks)

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(b) Before the incident at Fukushima, protective equipment and practices were used to reduce workers' exposure to radiation in the plant. List **five** ways in which workers could have reduced their exposure to radiation. (5 marks)

1:_____

2:_____

3:_____

4:_____

5:_____

Most nuclear power stations use pressurised water reactors.

(c) Describe the type of nuclear reaction that occurs inside pressurised water reactors. (2 marks)

Description: _____

_____

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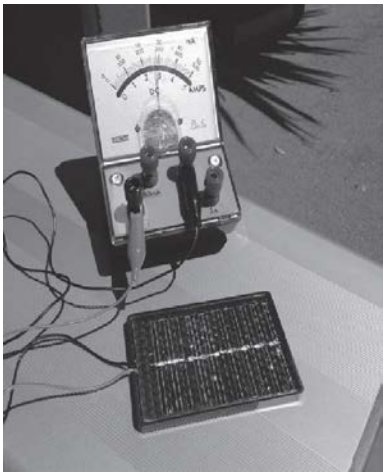
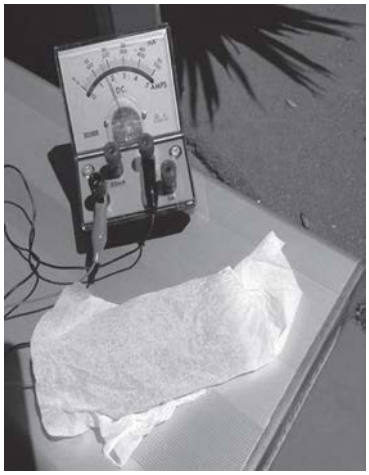
(d) Draw a labelled diagram of a pressurised water reactor, showing **five** major components.
(7 marks)

Question 12 **(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 seconds and the maximum current was recorded.

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

(a) Identify the independent variable. (1 mark)

_____

(b) Identify the dependent 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)

_____

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

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

1:_____

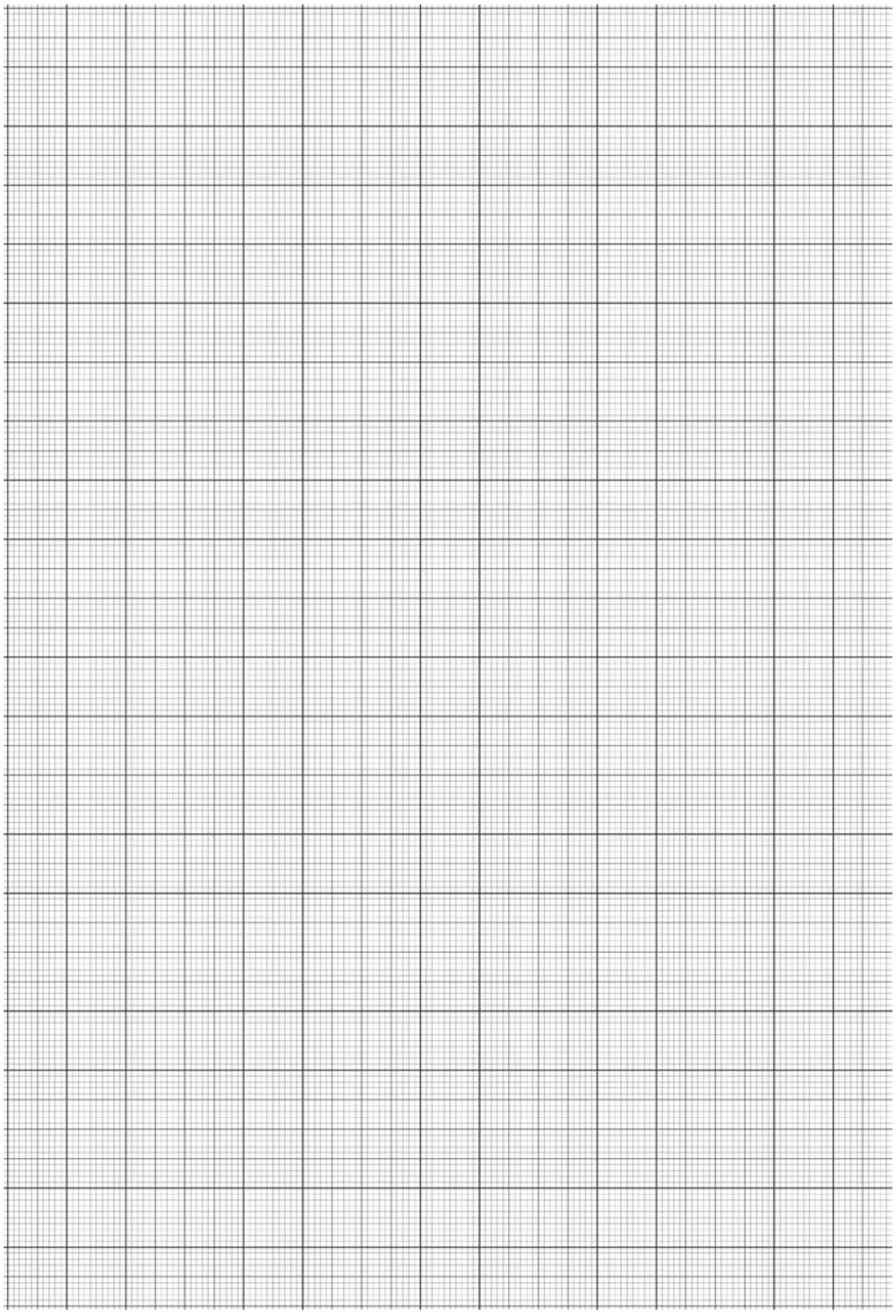
2: _____

(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 the previous page. (5 marks)

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



(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)

1:_____

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2:_____

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3:_____

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(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)

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Question 13 **(17 marks)**

The idea that energy cannot be created or destroyed, but can be transformed, is one of the fundamental principles of science.

(a) Define the term 'energy transformation' and give an example. (2 marks)

_____

_____

(b) In the table below, for the two common appliances that use electrical energy, identify the intended form of energy output for the appliance and the forms of energy that are 'lost' during the energy transformation. (4 marks)

Energy transformations in household appliances		
Appliance	**Intended form of energy output**	**Forms of energy lost**
Kettle		
Washing machine		

(c) (i) If electricity costs 21.87c per unit (kW h), calculate the cost of operating a 40 W incandescent globe from 6 pm until 10.30 pm. Show **all** workings. (4 marks)

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(ii) Calculate the cost of running a 12 W energy saver light globe for the same amount of time as in (i). Show **all** workings. (4 marks)

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_____

(iii) Using your answers to Parts (c)(i) and (c)(ii), calculate the cost savings that can be made by using a 12 W energy saver globe, instead of a 40 W incandescent globe from 6 pm to 10.30 pm. Show **all** workings. (1 mark)

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(iv) If there were 10 lights in the house and each light was changed from a 40 W globe to a 12 W energy saver light globe, calculate the cost saving for the year (365 days). Assume they were all on for four and a half hours each day. (2 marks)

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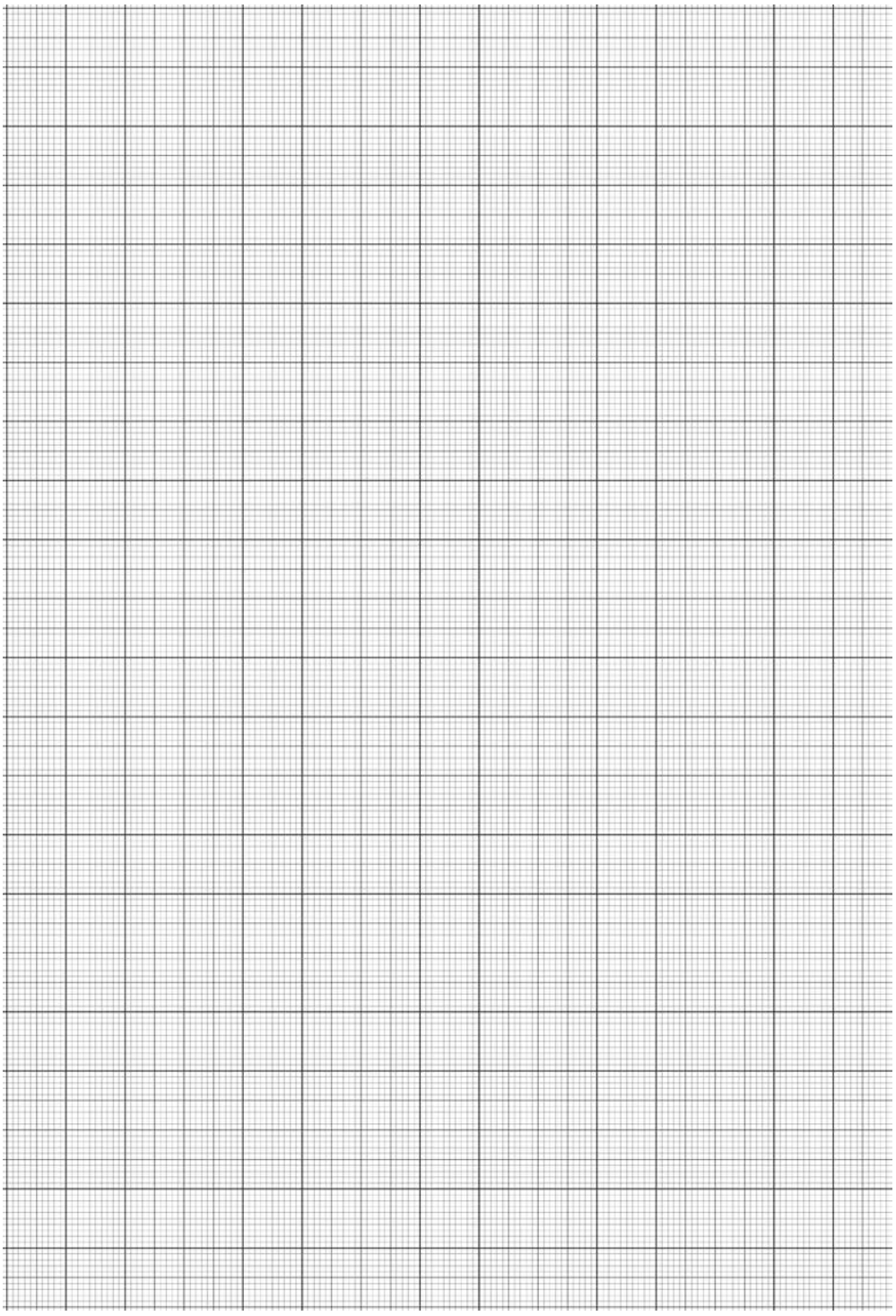
Spare grid for graph



End of test

Marking key for sample assessment task 10 – Unit 4

Section One: Multiple-choice

Description		Marks
Question	Answer	
1	a	1
2	c	1
3	d	1
4	d	1
5	a	1
6	d	1
7	b	1
8	c	1
9	b	1
10	c	1
	Total	**/10**

Section Two: Short answer

Question 11

(a) Explain what is meant by the term 'radioactive'.

Description	Marks
Particles or radiation emitted	1
Energy released	1
Mass converted to energy	1
Nucleus emits energy	1
Total	**/4**

(b) Before the incident at Fukushima, protective equipment and practices were used to reduce workers' exposure to radiation in the plant. List **five** ways in which workers could have reduced their exposure to radiation.

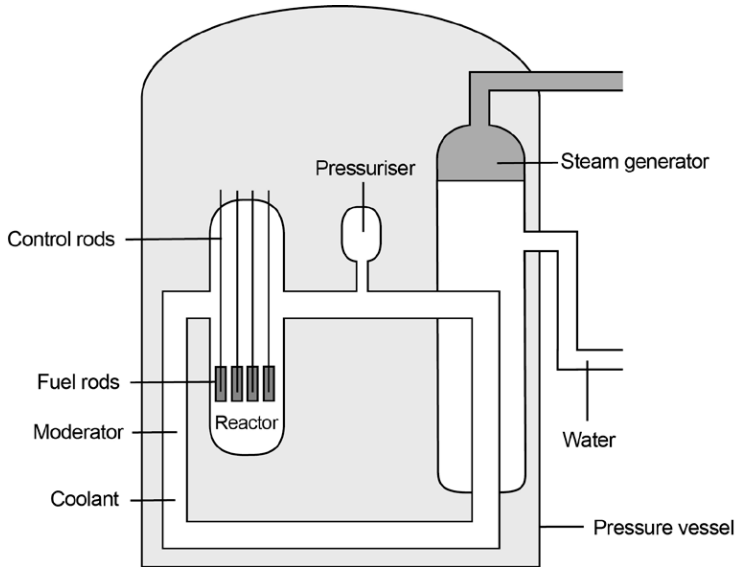
Description	Marks
Lists **five** ways in which workers could have reduced their exposure to radiation	1–5
Total	**/5**
Answer could include, but is not limited to:	
• limit exposure time • protective clothing, such as gloves • respirators • goggles • remote handling of materials/isolation barriers between worker and materials • safety procedures	

(c) Describe the type of nuclear reaction used by pressurised water reactors.

Description	Marks
A heavy atomic (UO_2) nucleus absorbs a neutron	1
The heavy atomic nucleus splits into two lighter fragments, releasing energy	1
Total	**/2**

(d) Draw a labelled diagram of a pressurised water reactor, showing the **five** major components.

Description	Marks
Diagram	1–2
Pressure vessel	1
Control rods	1
Fuel rods	1
Moderator	1
Coolant	1
Total	**/7**



Question 12

(a) Identify the independent variable.

Description	Marks
The layers of tissue paper	1
Total	**/1**

(b) Identify the dependent variable.

Description	Marks
The current	1
Total	**/1**

(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)?

Trial 2 – 90 mA – three layers of tissue covering solar cell	1
Total	**/1**

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

Description	Marks
Any suitable explanation	1
Total	**/1**
Answer could include, but is not limited to:	
• cloud passing overhead • shadow produced by investigator • variation in the amount of energy landing on the solar cell	

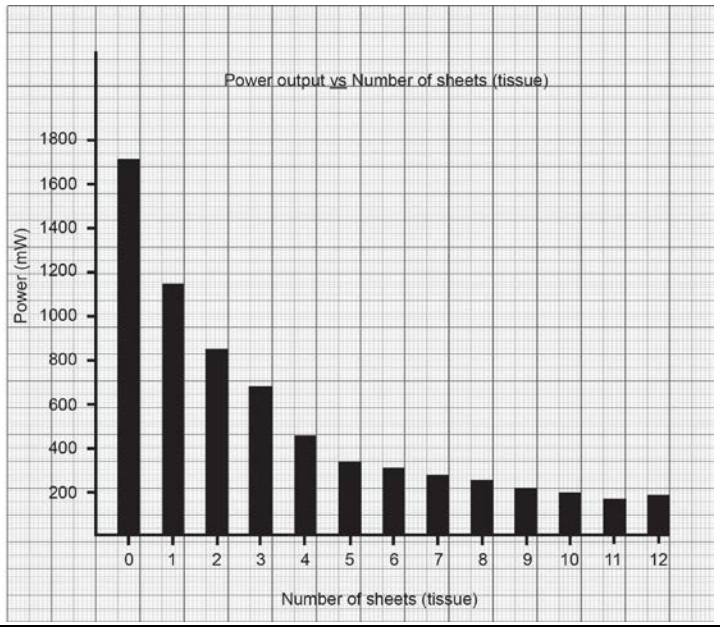
(e) (i) What **two** pieces of information do you need in order to calculate the power of a solar cell?

Description	Marks
Current	1
Voltage	1
Total	**/2**

(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)

Description		Marks
One tissue: P = V x I = 6 x 192 = 1152 mA		1
One tissue	1152	1
Four tissues	432	1
Seven tissues	318	1
11 tissues	192	1
Total		**/5**

(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 the previous page.

Description	Marks
Displays data in a suitable graph • title • *x*-axis label and units • *y*-axis label and units • points plotted correctly • data presented as a column graph (data are discrete)	1–5
Total	**/5**
Answer could include, but is not limited to:	
	

(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?

Description	Marks
Increasing cloud cover leads to decrease in power output by solar cell	1
Limited loss of power when number of sheets of paper increases above nine	1
The decrease is less for each increase in the number of tissue sheets	1
Total	**/3**

(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.

Description	Marks
1710/198 = 8.6	1
Nine panels needed	1
Total	**/2**

Question 13

(a) Define the term 'energy transformation' and give an example.

Description	Marks
A change in the form of energy	1
Any suitable answer	1
Total	**/2**
Answer could include, but is not limited to:	
• chemical energy to kinetic energy in human movement • chemical energy to electric energy in a dry cell • electric energy to heat energy in a toaster	1

(b) In the table below, for the two common appliances that use electrical energy, identify the intended form of energy output for the appliance and the forms of energy that are 'lost' during the energy transformation.

Description			Marks
Energy transformations in household appliances			
Appliance	**Intended form of energy output**	**Forms of energy lost**	
Kettle	heat	heat or sound	
Washing machine	kinetic (accept motion)	heat or sound	
Identification of correct energy form			1–4
Total			**/4**

(c) (i) If electricity costs 21.87c per unit (kW h), calculate the cost of operating a 40 W incandescent globe from 6 pm until 10.30 pm. Show **all** workings.

Description	Marks
Conversion to kW (40/1000 = 0.040)	1
Time multiplied by kW = 0.04 x 4.5 = 0.18	1
Multiplication by cost = 0.18 x 21.87	1
3.9c or $0.04	1
Total	**/4**

(ii) Calculate the cost of running a 12 W energy saver light globe for the same amount of time as in (i). Show **all** workings.

Description	Marks
Conversion to kW (12/1000 = 0.012)	1
Time multiplied by kW = 0.012 x 4.5 = 0.054	1
Multiplication by cost = 0.054 x 21.87	1
1.2c or $0.01	1
Total	**/4**

(iii) Using your answers to Parts (c)(i) and (c)(ii), calculate the cost savings that can be made by using a 12 W energy saver globe, instead of a 40 W incandescent globe from 6 pm to 10.30 pm. Show **all** workings.

Description	Marks
Calculate the difference 3.9–1.2 = 2.7c or $0.03	1
Total	**/1**

(iv) If there were 10 lights in the house and each light was changed from a 40 W globe to a 12 W energy saver light globe, calculate the cost saving for the year (365 days). Assume they were all on for four and a half hours each day.

Description	Marks
2.7c x 365 = $9.85	1
$9.85 x 10 (light globes) = $98.50	1
Total	**/2**