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

SAMPLE ASSESSMENT TASKS

AVIATION
GENERAL YEAR 11

Sample assessment task

Aviation – General Year 11

Task 8 — Unit 2

Assessment type: Investigation – Fixed wing propellers

Conditions
Period allowed for completion of the task: 3 weeks

Task weighting
10% of the school mark for this pair of units

Propeller diameter and thrust **(46 marks)**

In this task you will plan, conduct and interpret results from an investigation to assess the effect of the diameter of a propeller on its thrust. You will be required to prepare a scientific report to summarise and explain your findings.

The steps involved
Phase 1 – Planning (individual followed by group refinement)
Phase 2 – Carrying out of experiment (group work)
Phase 3 – Data processing (individual followed by group refinement)
Phase 4 – Evaluation (individual followed by group refinement)

What you need to do

Planning

(a) Initially working on your own, complete the 'Planning' questions on the *Investigating propeller diameter and thrust* worksheet. You will be given 20 minutes of class time to do this. You need to show this to your teacher before the next step.

(b) Working in your group, discuss your individual planning, and refine your ideas through group discussion. Each member of the group will need to submit the revised answers to the 'Planning' questions.

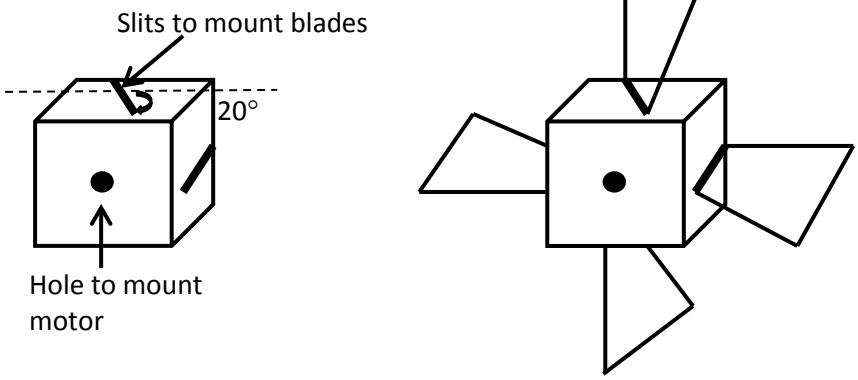
Conducting your experiment
Once your plan for comparing thrust has been checked by the teacher, collect the equipment you need and, in your group, carry out the experimental work.

Materials

- a 3 V DC motor
- a 3 V battery
- sheet of balsa wood
- 4 × 20 mm cubic wooden blocks
- cutting blade (e.g. Stanley knife or similar)
- wood glue
- a protractor
- cardboard to construct box for mounting motor and wheels
- four toy car tyres with two suitable rods for axles (or use wood dowelling rods to make axles)
- a stopwatch

Construction and mounting of propeller blades

1. Using a pencil, draw the shape of your propeller blades on to the sheet of balsa wood and cut the blades.
2. Cut slits into the wooden blocks to mount blades. Fit the blades and secure them with wood glue. Allow the glue to dry at least overnight before conducting the testing (see figures below)



Propeller blades mounted in wooden blocks

Construction and mounting of motor and battery

1. Using the cardboard provided, construct a box approximately 10 cm × 5 cm × 5 cm to house the motor and battery.
2. Mount the wheels using the dowelling rods as axles.
3. Design a method to mount the motor and its battery securely. The motor needs to be stable when it operates with the propeller. Ensure that the combined height of the wheels and mounting are sufficient for the longest propeller to be above the ground.

Processing the data and Evaluation

(a) Initially working on your own, complete the 'Data processing and 'Evaluation' questions on the *Investigating propeller diameter and thrust* worksheet. You will be given class time to do this. You need to show this to your teacher before the next step.

(b) Working in your group, discuss your individual data processing and evaluation, and refine your ideas through group discussion. Each member of the group will need to submit the revised answers to the 'Data processing' and 'Evaluation' questions.

Investigating propeller diameter and thrust

Planning **(16 marks)**

1. State the aim of your investigation. (2 marks)

2. Write a hypothesis for the experiment. (2 marks)

3. State the independent variable (i.e. variable to be varied) in the investigation. (1 mark)

4. State the dependent variable (i.e. variable to be measured) in the investigation. (1 mark)

5. Name **three (3)** variables which need to be controlled in the investigation. (3 marks)

6. Plan and describe how you will assess the thrust for each of the different blade sizes. You will need to consider how variables will be controlled. (5 marks)

Refinements to your planning after group discussion. (2 marks)

Conducting **(10 marks)**

1. Ensure that you conduct your investigation in an orderly and safe way.

(4 marks)

2. Present your results in a table. (If you choose to use a spreadsheet for recording data, printouts of these sheets should be attached.)

(6 marks)

Processing of data **(14 marks)**

1. Show a graphical representation of your data. (You can either use the grid below or attach a separate graph.) (5 marks)

2. Describe the trends in the data. (3 marks)

Individual ideas

Refinements after group discussion (1 mark)

3. Using science concepts, explain the patterns, trends or relationships you have identified in your data. (4 marks)

Individual ideas

Refinements after group discussion (1 mark)

Evaluation **(6 marks)**

1. Do the data support the hypothesis? Explain. (2 marks)

Individual ideas

Refinements after group discussion

2. Identify any sources of experimental error. Suggest how the experimental design may have been improved to reduce any errors. If you think no changes are needed, explain why not.
(4 marks)

Individual ideas

Refinements after group discussion

ACKNOWLEDGEMENTS

Construction and mounting of propeller blades

Concept from: *Effect of propeller size on thrust produced*. (2013). Retrieved June, 2014, from www.all-science-fair-projects.com/project1200_57_2.html

Investigating propeller diameter and thrust

Concept from: Hackling, M. W. (2005). *Working scientifically: Implementing and assessing open investigation work in science* (Rev. ed.) (Appendices 2 & 3: Planning and report worksheet for science investigations). Perth: Department of Education and Training, pp. 27–38.

Marking key for sample assessment task 8 – Unit 2

Investigating propeller diameter and thrust

Planning **(16 marks)**

1. State the aim of your investigation.

Description	Marks
Clearly states an aim related to the investigation/refined aim is related to the investigation	2
Provides a vague aim	1
Total	**2**

2. Write a hypothesis for the experiment.

Description	Marks
States a hypothesis that describes the relationship between the dependent and the independent variable	2
Hypothesis not in correct format/doesn't relate the dependent and independent variable	1
Total	**2**

3. States the independent variable (i.e. variable to be varied) in the investigation.

Description	Marks
Correctly states the independent variable (initially or refined) e.g. size of the propeller blades	1
Total	**1**

4. State the dependent variable (i.e. variable to be measured) in the investigation.

Description	Marks
Correctly states the dependent variable (initially or refined) e.g. speed at which the boxes move	1
Total	**1**

5. Name **three (3)** variables that need to be controlled in the investigation.

Description	Marks
Identifies three controlled variables (initially or refined) e.g. power of the motor, angle of the blades, size of the box, distance covered by the box	1–3
Total	**3**

6. Plan and describe how you will assess the thrust for each of the different blade sizes. You will need to consider how variables will be controlled.

Description	Marks
Method • uses at least four different propeller diameters/sizes • recognises that thrust can be measured by the time taken to cover a set distance • uses a distance that takes more than 10 seconds to reduce timing errors • uses repeat trials to get average time • describes how variables identified in the planning phase will be controlled	1–5
Total	**5**

Refinements to your planning after group discussion

Description	Marks
Shows evidence of refinements/justifies planning decisions	2
Makes small changes to planning	1
Total	**2**

Conducting **(10 marks)**

1. Ensure that you conduct your investigation in an orderly and safe way.

Description	Marks
Organisation and safety Maintains an organised work area/works safely	2
Less organised/needs to be reminded about safe practice	1
Model construction Well-constructed models fit for purpose	2
Models dimensions are problematic	1
Total	**4**

2. Present your results in a table. (If you choose to use a spreadsheet for recording data, printouts of these sheets should be attached.)

Description	Marks
Constructs appropriate table and records results • Columns clearly labelled • Units included in headings • Places the independent variable in the left-hand column and the dependent variable in the right-hand columns • Records at least three trials • Calculates the average for each blade size	1–5
• Equipment cleaned and returned appropriately	1
Total	**6**

Processing of data **(14 marks)**

1. Show a graphical representation of your data. (You can either use the grid below or attach a separate graph.)

Description	Marks
Draws appropriate graph to show trends in the data • uses appropriate type of graph (continuous data – line graph) • constructs graph with correct axes (x = size of propeller blades; y = thrust/time taken to cover distance) • labels axes correctly including units • graphs the average (not each trial) • plots graph accurately	1–5
Total	**5**

2. Describe the trends in the data.

Description	Marks
States the trend in the data e.g. thrust increases with propeller diameter, supporting with specific data from the investigation	2–3
States the trend in the data without any supporting data	1
Total	**3**

Refinements after group discussion

Description	Marks
After group discussion, shows evidence of refinements/justifies interpretation	1
Total	**1**

3. Using science concepts explain the patterns, trends or relationships you have identified in your data.

Description	Marks
• Makes links between the measurements used in the investigation and the thrust • Explains data using relevant science concepts e.g. relates the amount of air displaced by larger diameter propeller to explain higher thrust	3–4
Provides a brief explanation of data using relevant science concepts	2
Identifies relevant concepts but does not provide an explanation	1
Total	**4**

Refinements after group discussion

Description	Marks
After group discussion, shows evidence of refinements/justifies interpretation	1
Total	**1**

Evaluation **(6 marks)**

1. Does the data support the hypothesis? Explain.

Description	Marks
Makes a valid statement relating hypothesis to results and provides evidence to support this statement	2
Makes a valid statement relating hypothesis to results without support evidence	1
Total	**2**

2. Identify any sources of experimental error. Suggest how the experimental design may have been improved to reduce any errors. If you think no changes are needed, explain why.

Description	Marks
Identifies relevant sources of error in the experimental design e.g. no repeats, distance too small to be measured accurately, variables not adequately controlled (angle of blades)	2
Identifies difficulties encountered in the investigation, but these are not associated with the experimental design e.g. conducting issues such as problems with the equipment	1
Suggests possible improvements in the experimental design related to the errors identified/justifies lack of need for changes to experimental design	2
Suggests possible improvements in the experimental design not related to the errors identified	1
Total	**4**

Sample assessment task

Aviation – General Year 11

Task 7 — Unit 2

Assessment type: Test

Conditions
Time for the task: 45 minutes

Task weighting
6% of the school mark for this pair of units

Communications test

Multiple choice **(10 marks)**

1. Very Low Frequency (VLF) radio waves travel at a speed that is

   (a) slower than the speed of sound.
   (b) slower than High Frequency (HF) radio waves.
   (c) faster than the speed of light.
   (d) the same as Ultra High Frequency (UHF) radio waves.

2. Which of the following contains elements that are not part of the phonetic alphabet?

   (a) Papa, Quebec, Sierra, Alfa, Charlie, Hotel
   (b) Delta, X-ray, Echo, Lima, Bravo, Oscar
   (c) Yankee, Foxtrot, Tango, Mike, Kilo, Golf, Romeo
   (d) Whiskey, Juliet, November, Uncle, Zulu, India

3. Which of the following is the approximate maximum range for Very High Frequency (VHF) communications between an aircraft at an altitude of 4000 feet above ground level (AGL) and a ground station at sea level?

   (a) 39 nautical miles
   (b) 87 nautical miles
   (c) 77 nautical miles
   (d) 102 nautical miles

4. A Very High Frequency (VHF) Antenna is located at Mean Sea Level (MSL). Given that an aircraft is maintaining an altitude of 2000 feet Above Mean Sea Level (AMSL), calculate the theoretical range of the signal. This range is closest to

   (a) 15 nautical miles.
   (b) 5.5 nautical miles.
   (c) 55 nautical miles.
   (d) 45 nautical miles.

5. Radio communications in the High Frequency (HF) band are most affected by changes in the

(a) ionosphere.
(b) thermosphere.
(c) stratosphere.
(d) troposphere.

6. A radio frequency that relies on the ionosphere for its propagation is

(a) 270 Hz.
(b) 8764 kHz.
(c) 121.5 MHz.
(d) 243 GHz.

7. Very High Frequency (VHF) radio waves travel at

(a) the speed of light.
(b) the speed of sound.
(c) 3×10^8 metres per minute.
(d) the speed of sound in ISA conditions.

8. A pilot of an aircraft conducting circuits on runway 06 Right at Jandakot class D airspace makes the following radio call on the downwind leg of the circuit: 'Romeo Romeo November, downwind touch and go'.

The tower responds with 'Romeo Romeo November, cleared touch and go'.

The pilot's subsequent response should be

(a) 'Romeo Romeo November'.
(b) 'Jandakot Tower, cleared touch and go'.
(c) 'copied Romeo Romeo November'.
(d) 'cleared to land, Romeo Romeo November'.

9. 'Three', on the communications readability scale of 1 to 5, indicates that a radio transmission is

(a) perfectly readable.
(b) readable.
(c) readable but with difficulty.
(d) unreadable.

10. Which of the following are primarily used to make long-distance radio transmissions?

(a) reflected ground waves
(b) direct waves
(c) sky waves
(d) ground waves.

Short answer **(25 marks)**

11. During VHF communication, the press to talk button becomes stuck in the transmit position. List **two (2)** consequences of this situation. (2 marks)

12. List the **three (3)** types of radio transmission that are strictly prohibited when communicating on Air Traffic Control frequencies. (3 marks)

13. Describe the meaning of each of the following taxiway, runway or aerodrome markers.

(a) A single white cross on the manoeuvring area (1 mark)

(b) A single white cross adjacent to the primary wind indicator (1 mark)

(c) A pair of solid yellow lines followed immediately by a pair of broken yellow lines across a taxiway at a controlled aerodrome (1 mark)

(d) A double white cross adjacent to the primary wind indicator at an uncontrolled aerodrome (1 mark)

(e) A white horizontal dumb-bell signal adjacent to the wind indicator (1 mark)

14. As the distance from a radio transmitter increases, the signal strength decreases.

(a) What is the correct term to describe this decrease in strength? (1 mark)

(b) Describe the primary reason for the weakening of these radio signals with increasing distance. (1 mark)

15. A pilot of Cessna 172 (VH-CZL) elects to land on runway 27 after having over flown the Albury CTAF (CERT) aerodrome, and subsequently descends to a circuit height on the non-active side. After turning towards mid-field crosswind, a radio call is recommended prior to crossing onto the active side of the runway. State the correct radio phraseology a pilot should transmit. (3 marks)

16. (a) A light aircraft is flying over the Perth beaches when the pilot realises that the aircraft's VHF radio has failed. Noticing that the transponder is operating, how should he indicate to Air Traffic Control (ATC) that radio failure has occurred? (1 mark)

(b) What is the function of the squelch control on a transceiver? Under what conditions should the squelch control be turned off? (2 marks)

17. Communication in the High Frequency (HF) band is possible because of the propagation of radio signals over large distances. Explain how this communication occurs, detailing the differences between night and day communication. A diagram may assist your answer. (4 marks)

18. On approach to Moorabin Aerodrome (Class D airspace), you obtain the Automatic Terminal Information Service (ATIS) and make your initial radio call at the designated reporting point. However, it is your belief that the transmission was not received and, after repeated attempts, you draw the conclusion that the VHF radio is inoperative. List **three (3)** options available to you that will assist in landing the aircraft in a safe manner. (3 marks)

Marking key for sample assessment task 7 — Unit 2

Multiple-choice **(10 marks)**

Question	Answer
1	d
2	d
3	c
4	c
5	a
6	b
7	a
8	d
9	c
10	c

Short answer **(25 marks)**

11. During VHF communication, the press to talk button becomes stuck in the transmit position. List **two (2)** consequences of this situation.

Description	Marks
Any two of the following: • open mike – only carrier wave and transmissions heard by others • unable to receive transmissions • interference when other parties try to use this frequency	1–2
Total	**/2**

12. List the **three (3)** types of radio transmission that are strictly prohibited when communicating on Air Traffic Control frequencies.

Description	Marks
Any three of the following: • personal or private information • profane or obscene language • deceptive or false information • improper use of call signs of other aircraft • non-operational requirements	1–3
Total	**/3**

13. Describe the meaning of each of the following taxiway, runway or aerodrome markers.

(a) A single white cross on the manoeuvring area

Description	Marks
The area marked by a cross or crosses with the area delineated by markers is unfit for use by aircraft	1
Total	**/1**

(b) A single white cross adjacent to the primary wind indicator

Description	Marks
The aerodrome is completely unserviceable	1
Total	**/1**

(c) A pair of solid yellow lines followed immediately by a pair of broken yellow lines across a taxiway at a controlled aerodrome

Description	Marks
A clearance is required to cross the runway or proceed beyond this holding point	1
Total	**/1**

(d) A double white cross adjacent to the primary wind indicator at an uncontrolled aerodrome

Description	Marks
Gliding operations in progress	1
Total	**/1**

(e) A white horizontal dumb-bell signal adjacent to the wind indicator

Description	Marks
Use hard surfaced runways, taxiways and aprons only	1
Total	**/1**

14. As the distance from a radio transmitter increases, the signal strength decreases.

(a) What is the correct term to describe this decrease in strength?

Description	Marks
Attenuation (absorption)	1
Total	**/1**

(b) Describe the primary reason for the weakening of these radio signals with increasing distance.

Description	Marks
Any one of the following: • radio wave is lost to the earth, the atmosphere, and sometimes to ionised layers above the earth • the radio energy available is spread out over a greater area (wave front)	1
Total	**/1**

15. A pilot of Cessna 172 (VH-CZL) elects to land on runway 27 after having over flown the Albury CTAF (CERT) aerodrome, and subsequently descends to a circuit height on the non-active side. After turning towards mid-field crosswind, a radio call is recommended prior to crossing onto the active side of the runway. State the correct radio phraseology a pilot should transmit.

Description	Marks
Must include: • identify airport at the beginning and end – Albury Traffic • must use call sign – Charlie Zulu Lima (Optional Cessna 172) • must state joining midfield crosswind for runway 27 or joining midfield crosswind for 27	1–3
Total	**/3**

16. (a) A light aircraft is flying over the Perth beaches when the pilot realises that the aircraft's VHF radio has failed. Noticing that the transponder is operating, how should he indicate to Air Traffic Control (ATC) that radio failure has occurred?

Description	Marks
Squawk 7600	1
Total	**/1**

(b) What is the function of the squelch control on a transceiver? Under what conditions should the squelch control be turned off?

Description	Marks
To mute receiver output noise when no signal is being received	1
When the signal is weak/low amplitude	1
Total	**/2**

17. Communication in the High Frequency (HF) band is possible because of the propagation of radio signals over large distances. Explain how this communication occurs, detailing the differences between night and day communication. A diagram may assist your answer.

Description	Marks
Sky wave is reflected by the ionosphere (surface wave and direct wave are attenuated)	1
Four layers of the ionosphere during day – frequencies like 6565 kHz and 8822 kHz	1
At night, four layers combine to form two – frequencies like 3461 kHz and 4684 kHz used	1
If the aircraft is positioned in the 'skip distance' zone, no communication is possible	1
Total	**/4**

18. On approach to Moorabin Aerodrome (Class D airspace), you obtain the Automatic Terminal Information Service (ATIS) and make your initial radio call at the designated reporting point. However, it is your belief that the transmission was not received and, after repeated attempts, you draw the conclusion that the VHF radio is inoperative. List **three (3)** options available to you that will assist in landing the aircraft in a safe manner.

Description	Marks
Stay VMC, broadcast intentions prefixed by 'transmitting blind'	1
Land at nearest most suitable non-controlled airfield not requiring radio broadcasts	1
Squawk 7600 on the transponder	1
Total	**/3**