



ATAR course examination, 2022

Question/Answer booklet

AVIATION

Please place your student identification label in this box

WA student number: In figures

--	--	--	--	--	--	--	--

In words

Time allowed for this paper

Reading time before commencing work: ten minutes

Working time: two and a half hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer booklet

Multiple-choice answer sheet

Number of additional
answer booklets used
(if applicable):

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination, navigation plotter (or ruler and protractor), flight computer

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of the examination

The Aviation ATAR course examination consists of a written component and a practical (performance) component.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of written examination
Section One Multiple-choice	20	20	30	20	20
Section Two Short answer	20	20	120	129	80
Total					100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2022: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.

2. 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. Do not use erasable or gel pens. 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.

Section Two: Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. Working or reasoning should be shown clearly when calculating or estimating answers.
4. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.
5. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

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. Do not use erasable or gel pens. 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.

1. An aircraft has travelled 260 nm in 80 minutes. At what distance apart should 10 minute markers be placed?
 - (a) 30 nm
 - (b) 32 nm
 - (c) 37 nm
 - (d) 40 nm

2. Indicated airspeed is the
 - (a) speed of the aircraft relative to the air.
 - (b) true airspeed corrected for errors.
 - (c) calibrated airspeed corrected for errors.
 - (d) speed shown on the airspeed indicator.

3. Typical Australian winter season weather patterns involve high pressure systems located overhead
 - (a) the Equator.
 - (b) southern Australia.
 - (c) northern Australia.
 - (d) the South Pole.

4. If an aircraft uses 50 litres of fuel in 85 minutes, the fuel flow in litres per hour is
 - (a) 30.
 - (b) 35.
 - (c) 40.
 - (d) 45.

5. The primary purpose of the manifold air pressure gauge is to indicate the
 - (a) engine speed based on the crankshaft.
 - (b) oil pressure between the oil pump and engine inlet.
 - (c) pressure of the fuel air mixture.
 - (d) cylinder head temperature.

See next page

6. A taxiing aircraft is experiencing a wind from behind and to the left. The left wing aileron should be positioned
- (a) down with down elevator.
 - (b) down with up elevator.
 - (c) up with down elevator.
 - (d) up with up elevator.
7. The primary purpose of stabilators is to
- (a) provide increased aircraft stability.
 - (b) combine vertical stabiliser and elevator.
 - (c) combine horizontal stabiliser and elevator.
 - (d) allow two individual stabilisers to move independently.
8. The airspeed limitation V_{fo} indicates the
- (a) flap operating speed.
 - (b) flap extension speed.
 - (c) flap retraction speed.
 - (d) turbulence penetration speed with flap selected.
9. To achieve maximum performance, most supersonic aircraft incorporate
- (a) a canard.
 - (b) forward-swept wings.
 - (c) straight wings.
 - (d) sweptback wings.
10. An aircraft in a normal climb will have an elevator position of
- (a) up and the trim tab deflected upward.
 - (b) up and the trim tab deflected downward.
 - (c) down and the trim tab deflected upward.
 - (d) down and the trim tab deflected downward.
11. A pilot with a colour vision defect is likely to have difficulty correctly interpreting which colours?
- (a) red and green
 - (b) red and white
 - (c) white and green
 - (d) red, white and green

12. An aircraft travelling at transonic speed will experience airflow that is
- (a) mostly subsonic with some supersonic.
 - (b) completely subsonic.
 - (c) some subsonic but mostly supersonic.
 - (d) completely supersonic.
13. As aircraft speed increases, a normal shock wave will move
- (a) aft.
 - (b) forward.
 - (c) at an angle relative to the wing.
 - (d) to below the wing.
14. The primary advantage of the turbocharger over the supercharger is that it
- (a) uses a more direct method of fuel injection.
 - (b) utilises power from the crankshaft.
 - (c) does not utilise power from the crankshaft.
 - (d) involves compressed air being fed to the inlet manifold.
15. During a Civil Aviation Safety Authority (CASA) regulation test, a result is considered positive when the number of grams of alcohol per 210 litres of breath is
- (a) 0.
 - (b) 0.02.
 - (c) 0.05.
 - (d) 0.08.
16. Given a pressure height of 240 ft and air temperature of 22 °C, the density height is
- (a) 1000 ft.
 - (b) 1140 ft.
 - (c) 1240 ft.
 - (d) 1400 ft.
17. The transition layer is a
- (a) fixed height layer with a variable lower level.
 - (b) fixed height layer based on QNH.
 - (c) variable height layer with a fixed upper level.
 - (d) variable height layer based on QNH.

18. If carbon monoxide poisoning is detected in the cockpit, the **best** course of action is to
- (a) counteract the source of poisoning.
 - (b) descend to a lower altitude.
 - (c) use the horizon as a visual cue.
 - (d) lower the aircraft's nose to a more horizontal angle.
19. Which of the following is **not** a high lift device?
- (a) wing flaps
 - (b) leading edge wing extensions
 - (c) leading edge slots
 - (d) ventral surfaces
20. Which of the following is correct in relation to magnetic variation? If
- (a) applying East, compass heading is higher.
 - (b) applying East, compass heading is lower.
 - (c) aircraft is decelerating, deviation is to the North.
 - (d) aircraft is accelerating, deviation is to the South.

End of Section One

See next page

Section Two: Short answer**80% (129 Marks)**

This section has **20** questions. Answer **all** questions. Write your answers in the spaces provided. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 120 minutes.

Question 21**(10 marks)**

Various kinds of equipment are used to assist in identifying an aircraft's position in relation to specified criteria.

- (a) Explain the purpose and operation of the Instrument Landing System (ILS). (5 marks)

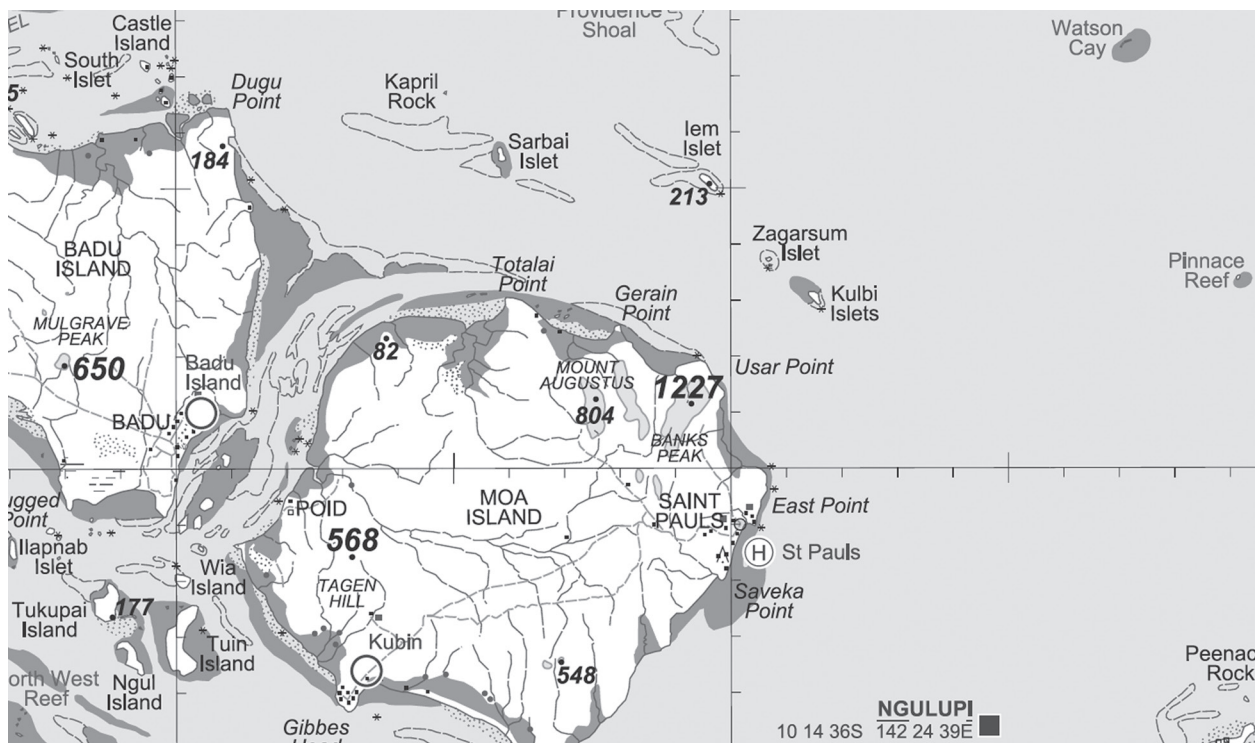
- (b) Explain the purpose and operation of automatic dependent surveillance broadcast (ADS-B). (5 marks)

See next page

Question 22

(10 marks)

Use the chart below for a flight from Badu Island aerodrome (YBAU) to Watson Cay to Ngulupi, and return to Badu Island aerodrome.



- Legend: ○ aerodrome
 (H) helipad

(a) Given cruising level lowest hemispherical altitude above 2000 feet, magnetic variation 5° East and cruising true air speed (TAS) 120 kt, complete the following flight plan information. (5 marks)

Position	Altitude	Track (T)	Heading (M)	Distance (nm)

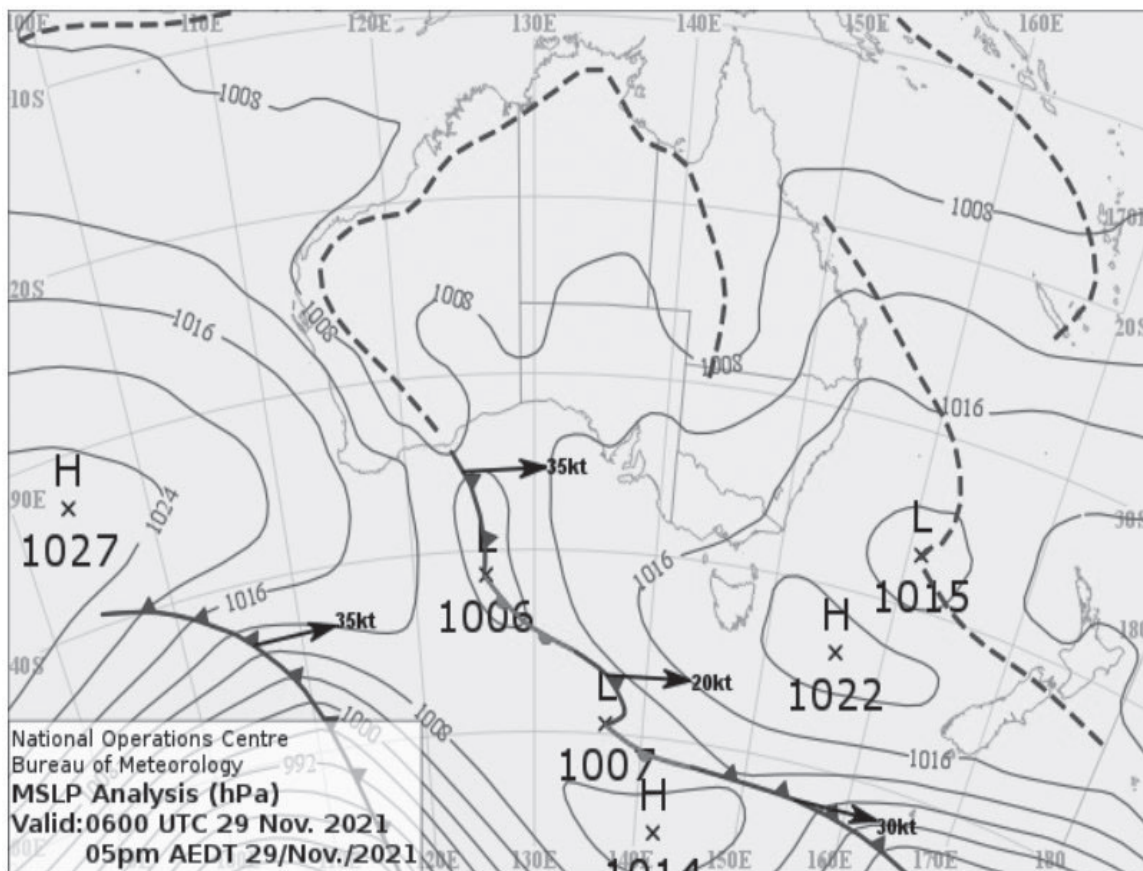
- (b) On the Ngulupi to Badu Island aerodrome leg, the aircraft is established off track over St Pauls Helipad. Using the 1 in 60 rule, calculate the track error to the nearest degree. Show all workings. (2 marks)

- (c) Taking the track error above, use the 1 in 60 rule to calculate the required closing angle and required heading for Badu Island. Show all workings. (3 marks)

Question 23

(7 marks)

Consider the synoptic chart shown below.



- (a) How many cold fronts are indicated? (1 mark)

- (b) Identify the mean sea level pressure to the nearest hectopascal at position 20°S, 160°E. (1 mark)

- (c) Identify the feature indicated by ----- (1 mark)

- (d) Draw the symbol for a warm front. (1 mark)

- (e) Interpret the meaning of the black arrow **→ 20kt** shown in the chart on page 10. (3 marks)

Question 24 (8 marks)

Safety is vital in aviation operations to ensure the wellbeing of those working in the industry, as well as that of customers. Discuss how the following can improve aviation safety in the cockpit and the aviation environment.

- (a) Good situational awareness (4 marks)

- (b) Good communication skills (4 marks)

Question 25

(4 marks)

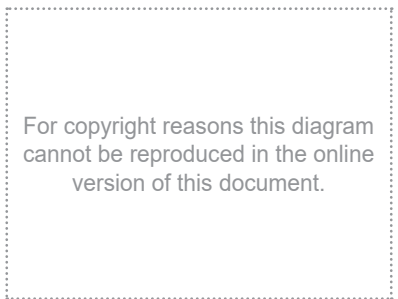
Stability is vital for the controllability of aircraft. A directionally stable aircraft experiencing rotation around the vertical axis (yaw) tends to return to straight and level flight. Explain the factors that enable the aircraft to return to its original altitude.

Question 26

(6 marks)

Forces acting on an aircraft have a significant impact on its operation. The aircraft below is in a climb with power. Use labelled arrows to show direction of

- the forces acting on this aircraft, and
- **two** resultant forces in this situation.



Question 27**(4 marks)**

It is accepted that good physical condition of the pilot is critical for top performance. A pilot flying after scuba diving experiences decompression sickness.

- (a) Define 'decompression sickness'. (1 mark)

- (b) State **two** symptoms of decompression sickness. (2 marks)

One: _____

Two: _____

- (c) How might the pilot reduce the effects of decompression sickness? (1 mark)

Question 28**(4 marks)**

The effects of spatial disorientation on a pilot can be dangerous.

- (a) Define 'spatial disorientation'. (1 mark)

- (b) State **two** possible negative outcomes if a pilot is spatially disoriented. (2 marks)

One: _____

Two: _____

- (c) Outline how a pilot can overcome the effects of spatial disorientation. (1 mark)

Question 29

(6 marks)

Weight and balance calculations are vital to the safety of an aircraft and its occupants.

- (a) Complete the table below for a Piper PA-32RT-300T Turbo Lance aircraft to show the weight, position of the centre of gravity and moment at zero fuel weight. (4 marks)

Position	Weight (lb)	Arm (in)	Moment (lb/in)
Aircraft	2335.8		195 086
Front	355	85.5	
Centre	15	118.1	
Rear	350	157.6	
Forward baggage	0	42.0	
Aft baggage	0	178.7	
Zero fuel weight			

- (b) Using the Piper PA32 RT-300T take-off weight chart on the next page and the following data:

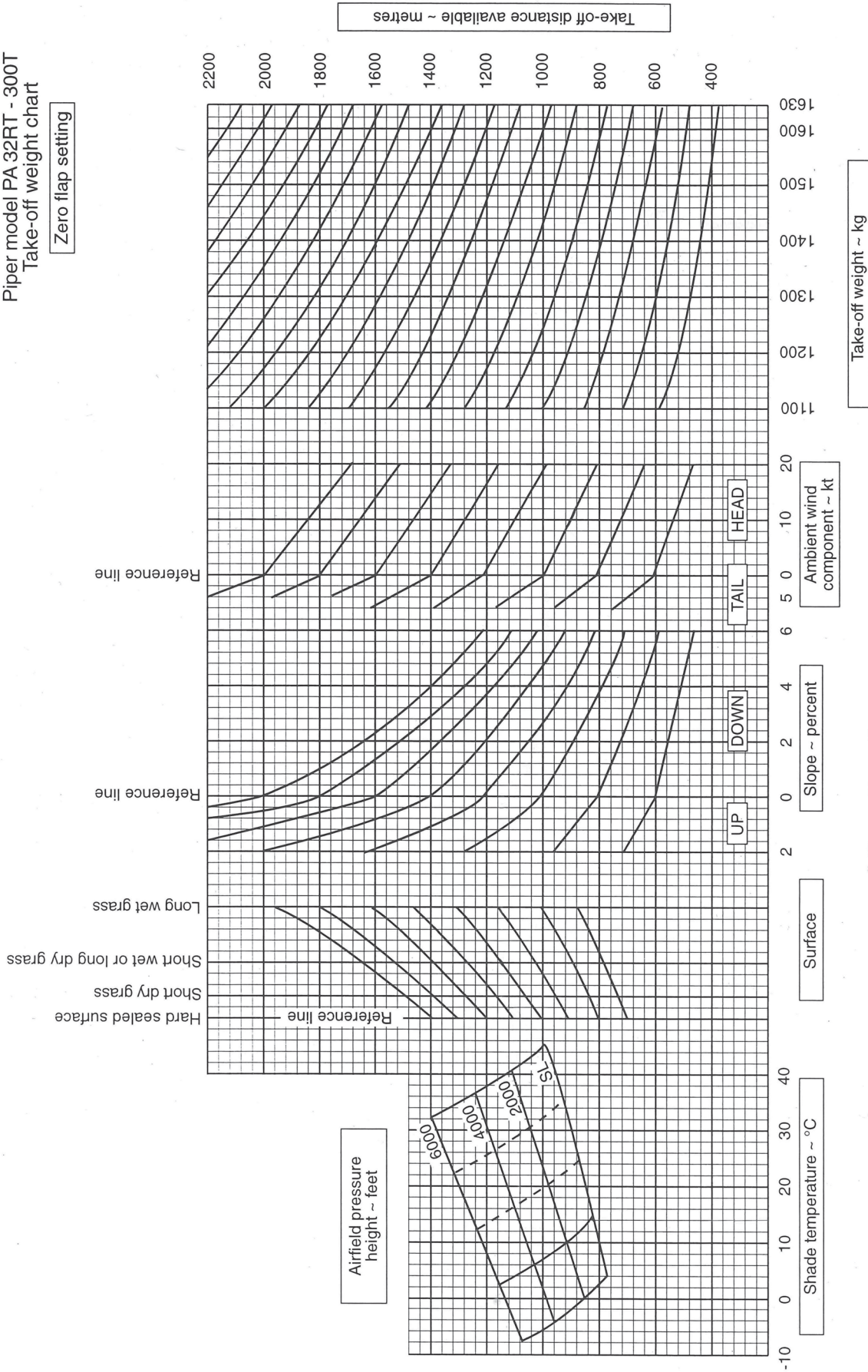
- OAT 26 °C
- PH 1500 ft
- surface long dry grass
- slope 1% up
- 9 kt headwind
- take-off weight 1550 kg,

calculate the take-off distance required. Show **all** workings.

(2 marks)

Piper model PA 32RT - 300T
Take-off weight chart

Zero flap setting



Flap setting ~ Zero
 Take-off safety speed 78 kt IAS
 Power setting ~ Take-off
 ~ RPM 2700
 Chart distance factor 1:15

Question 30

(9 marks)

Gravity-induced loss of consciousness (G-LOC) has a significant effect on the human body.

- (a) Explain the concept of G-LOC. (4 marks)

- (b) Identify **three** effects on the human body in an aircraft that proceeds from 1G through to 4G. (3 marks)

One: _____

Two: _____

Three: _____

- (c) Describe how the above effects on the human body can be reduced. (2 marks)

Question 31

(4 marks)

During summer, Australia experiences longer periods of daylight than throughout winter. Explain the reason for this.

Question 32

(8 marks)

Weather phenomena can have significant impacts on aviation operations.

- (a) Explain the formation of radiation fog. (4 marks)

- (b) State **four** requirements for the formation of radiation fog. (4 marks)

One: _____

Two: _____

Three: _____

Four: _____

Question 33

(5 marks)

Due to the operational limitations of the magnetic compass, other instruments tend to be preferred for identifying aircraft heading. Outline the **five** limitations encountered when using a magnetic compass.

One: _____

Two: _____

Three: _____

Four: _____

Five: _____

Question 34

(3 marks)

Explain the effect of altitude on the performance of propeller-driven aircraft.

Question 36

(6 marks)

Most basic aircraft have a standard fixed propeller for simplicity, although an alternative propeller design exists that can be used.

- (a) State the name of the alternative propeller design and outline its primary advantage. (2 marks)

Name: _____

Advantage: _____

- (b) The ability to utilise this alternative propeller design has other benefits. Name **two** additional functional benefits of this design and state the resulting advantages. (4 marks)

Benefit	Advantage
One:	
Two:	

Question 37

(8 marks)

Aviation reports and forecasts are vital to the safety of aviation operations within Australia.

- (a) Identify **two** weather reports and state their purpose. (4 marks)

One: _____

Two: _____

- (b) Identify **two** weather forecasts and state their purpose. (4 marks)

One: _____

Two: _____

Question 38

(13 marks)

It is vital for a helicopter pilot to understand the controls as well as forces acting on the aircraft in different scenarios.

- (a) A helicopter is established in autorotative flight at a steady forward airspeed of 60 knots. Using the diagram provided, draw and label the forces acting on the aircraft during this phase of flight. (7 marks)

For copyright reasons this diagram cannot be reproduced in the online version of this document.

- (b) A helicopter pilot is sitting in their aircraft on the ground with the engine running and all checks complete. State the name of each of the **three** primary controls that will be used to conduct a take-off to forward flight and outline the associated function. (6 marks)

Primary control	Function

Question 39

(3 marks)

One of the primary negative impacts of the aviation industry is noise. This creates pressure to design aircraft which limit their noise contour. State **three** ways in which aircraft can be designed to reduce their level of noise on the surrounding community.

One: _____

Two: _____

Three: _____

Question 40

(6 marks)

Air traffic congestion in various parts of the world is increasingly affecting further development of aviation, both positively and negatively. Explain the effects of congestion on the following:

Aviation industry: _____

Community: _____

Environment: _____

ACKNOWLEDGEMENTS

- Question 22** Chart adapted from: Airservices Australia. (2021). *Horn Island VTC* [AIP Chart]. Retrieved April, 2022, from <https://www.airservicesaustralia.com/aip/aip.asp?pg=60&vdate=02DEC2021§=VTC&ver=1>
- Question 23** Chart adapted from: Bureau of Meteorology. (2021). *Analysis for 06:00 UTC on Monday 29 November 2021* [MSLP analysis]. Retrieved November, 2021, from http://www.bom.gov.au/australia/charts/synoptic_col.shtml
Used under Creative Commons Attribution 3.0 Australia licence.
- Question 26** Image adapted from: Hartley, A. (2016). [Diagram of aeroplane with the four forces of flight]. Retrieved June, 2022 from <http://smartflighttraining.com/>
- Question 29(b)** Chart from: Yeo, M., Bowers, G., & Bennett, K. (2001). Piper model PA32RT - 300T: Take-off weight chart. *Handbook of flight* (2nd ed.). WestOne Services, p. 147.
Not for operational purposes.
- Question 38(a)** Diagram adapted from: Federal Aviation Administration (DOT). (1973). Chapter 2. Aerodynamics of flight (Fig. 10). *Basic helicopter handbook*, p. 8. Retrieved June, 2022, from <http://avstop.com/ac/basichelicopterhandbook/ch2.html>

This document – apart from any third party copyright material contained in it – may be freely copied, or communicated on an intranet, for non-commercial purposes in educational institutions, provided that it is not changed and that the School Curriculum and Standards Authority (the Authority) is acknowledged as the copyright owner, and that the Authority's moral rights are not infringed.

Copying or communication for any other purpose can be done only within the terms of the *Copyright Act 1968* or with prior written permission of the Authority. Copying or communication of any third party copyright material can be done only within the terms of the *Copyright Act 1968* or with permission of the copyright owners.

Any content in this document that has been derived from the Australian Curriculum may be used under the terms of the Creative Commons [Attribution 4.0 International \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) licence.

An *Acknowledgements variation* document is available on the Authority website.