



## ATAR course examination, 2021

### 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	23	23	120	129	80
<b>Total</b>					100

## Instructions to candidates

- The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2021: Part II Examinations*. 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. 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.

- Working or reasoning should be shown clearly when calculating or estimating answers.
- 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.
- 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. The descriptor used to identify seven OKTAS of cloud is
  - (a) SKC.
  - (b) FEW.
  - (c) SCT.
  - (d) BKN.
  
2. An altimeter set to QFE will indicate the height
  - (a) above mean sea level.
  - (b) above ground level.
  - (c) above transition level.
  - (d) below transition level.
  
3. To ensure aircraft are as safe as possible, the most significant parts will
  - (a) have backup systems.
  - (b) include an aircraft communications and reporting system (ACARS).
  - (c) be composed of composite materials.
  - (d) result from computer-aided design.
  
4. Calibrated airspeed is the
  - (a) speed of the aircraft relative to the air.
  - (b) speed shown on the airspeed indicator.
  - (c) indicated airspeed corrected for errors.
  - (d) true airspeed corrected for errors.
  
5. The airspeed limitation  $V_b$  indicates
  - (a) turbulence penetration speed.
  - (b) maximum manoeuvring speed.
  - (c) flap operating speed.
  - (d) stall speed.

**See next page**

6. Vortex generators are generally positioned
- (a) obliquely to initiate flow separation.
  - (b) parallel to delay flow separation.
  - (c) obliquely to delay flow separation.
  - (d) parallel to initiate flow separation.
7. The difference in time between meridians of longitude is based on the
- (a) distance between meridians.
  - (b) universal time coordinated (UTC).
  - (c) time interval of the Sun between meridians.
  - (d) position of the Sun for the season.
8. Spoilers are designed to
- (a) increase lift and increase drag.
  - (b) reduce lift and increase drag.
  - (c) increase lift and reduce drag.
  - (d) reduce lift and reduce drag.
9. The time at location Alpha is 0900 UTC on 24 July. Alpha is in a UTC +10 time zone. What is the local time at Alpha?
- (a) 1900 on 23 July
  - (b) 1900 on 24 July
  - (c) 2300 on 23 July
  - (d) 2300 on 24 July
10. An aircraft is cruising at 150 kt on a heading of  $140^\circ$  M. A wind of  $200^\circ$  M/15 kt would result in a crosswind of 14 kt from the
- (a) left and 8 kt headwind.
  - (b) right and 8 kt tailwind.
  - (c) left and 8 kt tailwind.
  - (d) right and 8 kt headwind.
11. On a helicopter, drag is created by airflow over the
- (a) entire aircraft.
  - (b) main rotor blade when spinning.
  - (c) fuselage only.
  - (d) aircraft in a vertical descent.

12. Secondary Surveillance Radar (SSR) relies upon which of the following?
- (a) ground station
  - (b) transponder
  - (c) satellite
  - (d) ground antenna array
13. The primary purpose of a canard is to provide additional
- (a) drag.
  - (b) control surfaces.
  - (c) manoeuvrability.
  - (d) lift.
14. Which of the following cloud types indicate an unstable atmosphere?
- (a) cumulonimbus
  - (b) nimbostratus
  - (c) stratus
  - (d) cirrus
15. In the most common aircraft electrical system, the alternator delivers
- (a) variable voltage.
  - (b) 240 volts.
  - (c) constant voltage.
  - (d) current to the battery.
16. Hyperventilation results in
- (a) a lack of oxygen.
  - (b) a lack of carbon dioxide.
  - (c) a high level of oxygen.
  - (d) an increase in haemoglobin.
17. The aeroplane night visual flight rules (VFR) alternate minima apply when the forecast cloud ceiling is
- (a) 1000 ft and visibility 6 km.
  - (b) 1000 ft and visibility 8 km.
  - (c) 1500 ft and visibility 6 km.
  - (d) 1500 ft and visibility 8 km.

18. Motion sickness experienced by a pilot operating an aircraft can be **most** effectively alleviated by them
- (a) lying down for an extended period.
  - (b) leaning forward for an extended period.
  - (c) looking toward the horizon.
  - (d) flying at a lower altitude.
19. Which of the following is **not** a characteristic of supersonic air? It
- (a) is undisturbed until an object approaches.
  - (b) breaks away turning sharp corners.
  - (c) slows down entering a venturi.
  - (d) has the greatest speed when pressure is least.
20. The term 'overshoot windshear' indicates that an aircraft will initially experience an overshooting of the desired approach path and/or
- (a) increasing airspeed.
  - (b) decreasing airspeed.
  - (c) constant airspeed.
  - (d) variable airspeed.

**End of Section One**

**See next page**

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

This section has **23** 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****(4 marks)**

Calculating pressure height and density altitude are essential to identifying aircraft performance.

Given the following data:

- airfield elevation 800 ft
- QNH 1003 hPa
- OAT 9 °C,

(a) calculate airfield pressure height. Show **all** workings. (2 marks)

---

---

---

---

---

---

---

Assume there has been a delay in departure and the pressure height is now calculated as 1500 ft.

(b) Calculate airfield density altitude. Show **all** workings. (2 marks)

---

---

---

---

---

---

---

**See next page**

**Question 22**

**(9 marks)**

Using the Graphical Area Forecast on page 9, identify the forecast:

- (a) visibility and associated conditions at YTEF (2 marks)

---

---

---

---

- (b) cloud at all levels for YPBO at 1100 UTC (3 marks)

---

---

---

---

---

---

- (c) turbulence description at YBRM (2 marks)

---

---

---

---

- (d) issue time and date in plain language (1 mark)

---

---

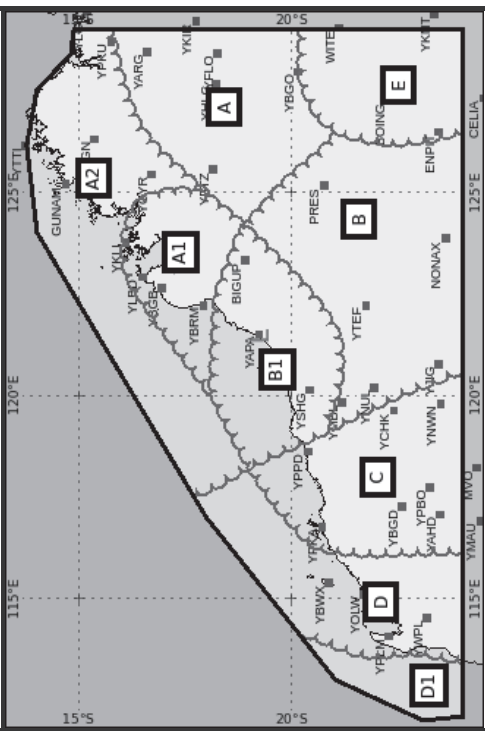
- (e) freezing level at YBWX. (1 mark)

---

---



Graphical Area Forecast SFC - 10000FT WA-N Issued at 2101220443Z - Valid 221100 to 221700Z Weather Features valid at 221100Z				
AREA	SURFACE VIS AND WX	CLOUD, ICING AND TURB	FZLVL	
<b>A</b>	>10KM NIL  2000M SCT SHRA, ISOL LAND FM 14Z  1000M OCNL TSRA, ISOL LAND FM 14Z	SCT ST 1500/2500FT A1/A2 LAND, BKN FM 15Z SCT CU/SC 5000/ABV10000FT, BASES TO 2000FT SEALAND W 50NM OF COAST  OCNL TCU 5000/ABV10000FT, ISOL LAND FM 14Z BKN ST 1000/3000FT  OCNL CB 5000/ABV10000FT, ISOL LAND FM 14Z BKN ST 1000/3000FT  MOD TURB BLW 6000FT A1 ONLY	ABV 10000FT	
<b>B</b>	7000M WDSPR -RA  2000M SCT RA	BKN ST 1500/2500FT (BASES 1000FT IN B1 ONLY) BKN CU/SC 2500/ABV10000FT  BKN ST 0500/2500FT OVC NS 2500/ABV10000FT  ISOL CB 2000/ABV10000FT (EMBD IN B1 ONLY) BKN ST 0500/2000FT  SEV TURB BLW 6000FT B1 ONLY	ABV 10000FT	
<b>C</b>	>10KM NIL  3000M SCT SHRA, ISOL FM 12Z, CEASING AT 15Z  1000M OCNL TSRA, ISOL FM 12Z, CEASING AT 15Z	SCT CU/SC 8000/ABV10000FT  OCNL TCU 8000/ABV10000FT, ISOL FM 12Z SCT SC 5000/8000FT  OCNL CB 8000/ABV10000FT, ISOL FM 12Z SCT SC 5000/8000FT	ABV 10000FT	
<b>D</b>	>10KM NIL	SCT CU/SC 2000/3000FT D1 ONLY SCT CU/SC 8000/ABV10000FT LAND	ABV 10000FT	
<b>E</b>	>10KM NIL	SCT CU/SC 8000/ABV10000FT	ABV10000FT	



All heights AMSL  
 TS / CB / TCU implies SEV ICE and SEV TURB  
 CU / SC / AC implies MOD TURB      CLD ABV FZLVL implies MOD ICE  
 Speed of movement in KT      ● refers to Critical Locations  
 ■ refers to Limit of Forecast  
 Check AIRMETS, SIGMETs and NOTAMS

REMARKS:

For more information contact (08) 9263 2259

**Question 23**

**(6 marks)**

Although the magnetic compass is an instrument essential for flight, there are problems associated with its use. Explain how each of the following problems occurs when using a magnetic compass.

(a) Magnetic variation

(3 marks)

---

---

---

---

---

---

---

(b) Deviation

(3 marks)

---

---

---

---

---

---

---

**Question 24****(3 marks)**

An aircraft is established on a bearing of  $070^\circ$  from an NDB and on the  $210^\circ$  radial from a VOR. The aircraft heading is  $330^\circ$ .

Draw a diagram to show the correct position of the aircraft relative to the navigation aids.

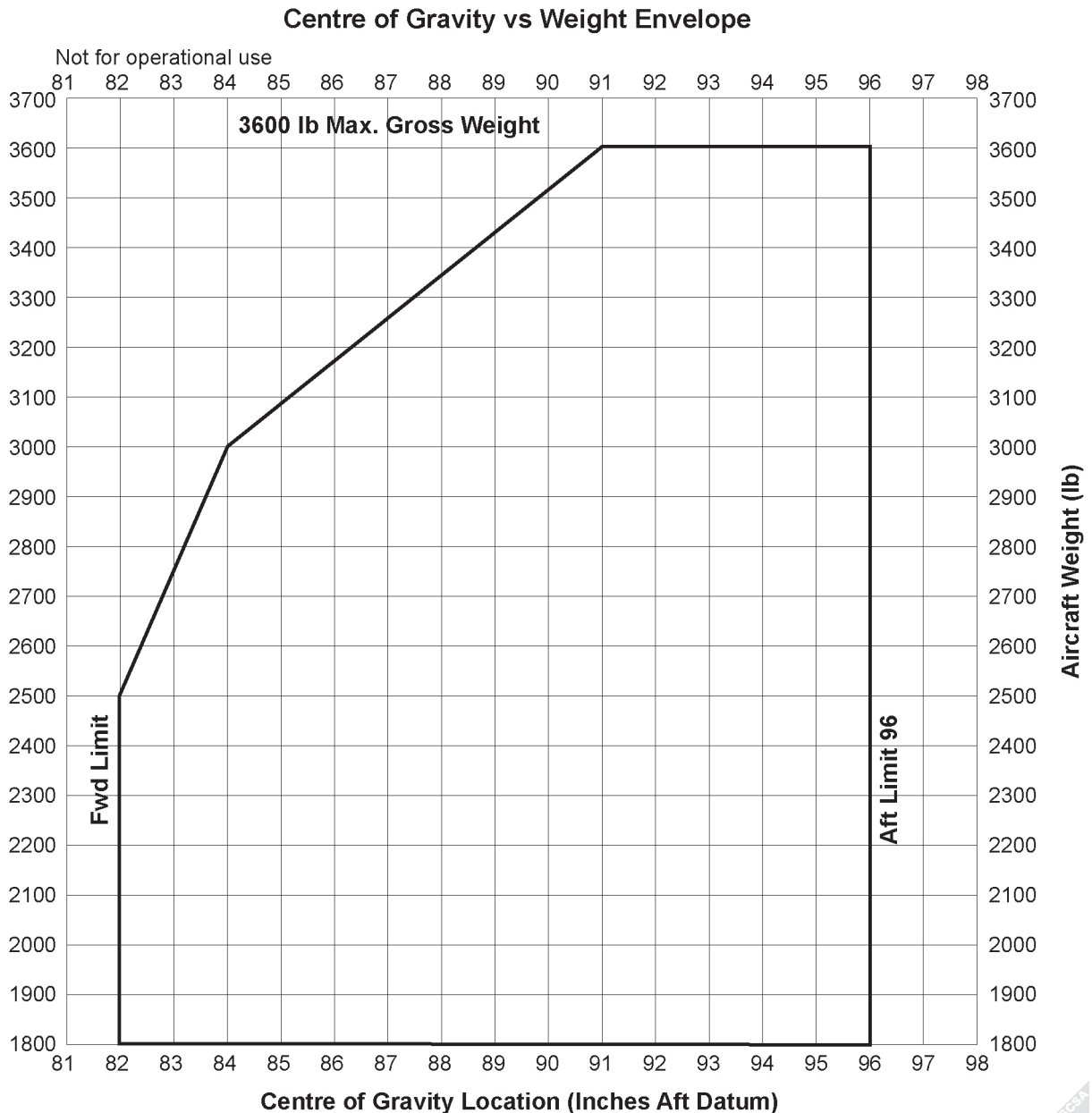
Question 25

(5 marks)

A pilot is planning a flight from Delta aerodrome to Echo aerodrome with the following load data.

	Weight (lb)	Arm (in)	Moment (lb/in)
Zero fuel weight (1)	2950	88	259 600
Take-off weight (2)	3450	90	310 500

- (a) Use the centre of gravity vs weight envelope chart provided to plot and label the zero fuel weight (1) and take-off weight (2). (2 marks)

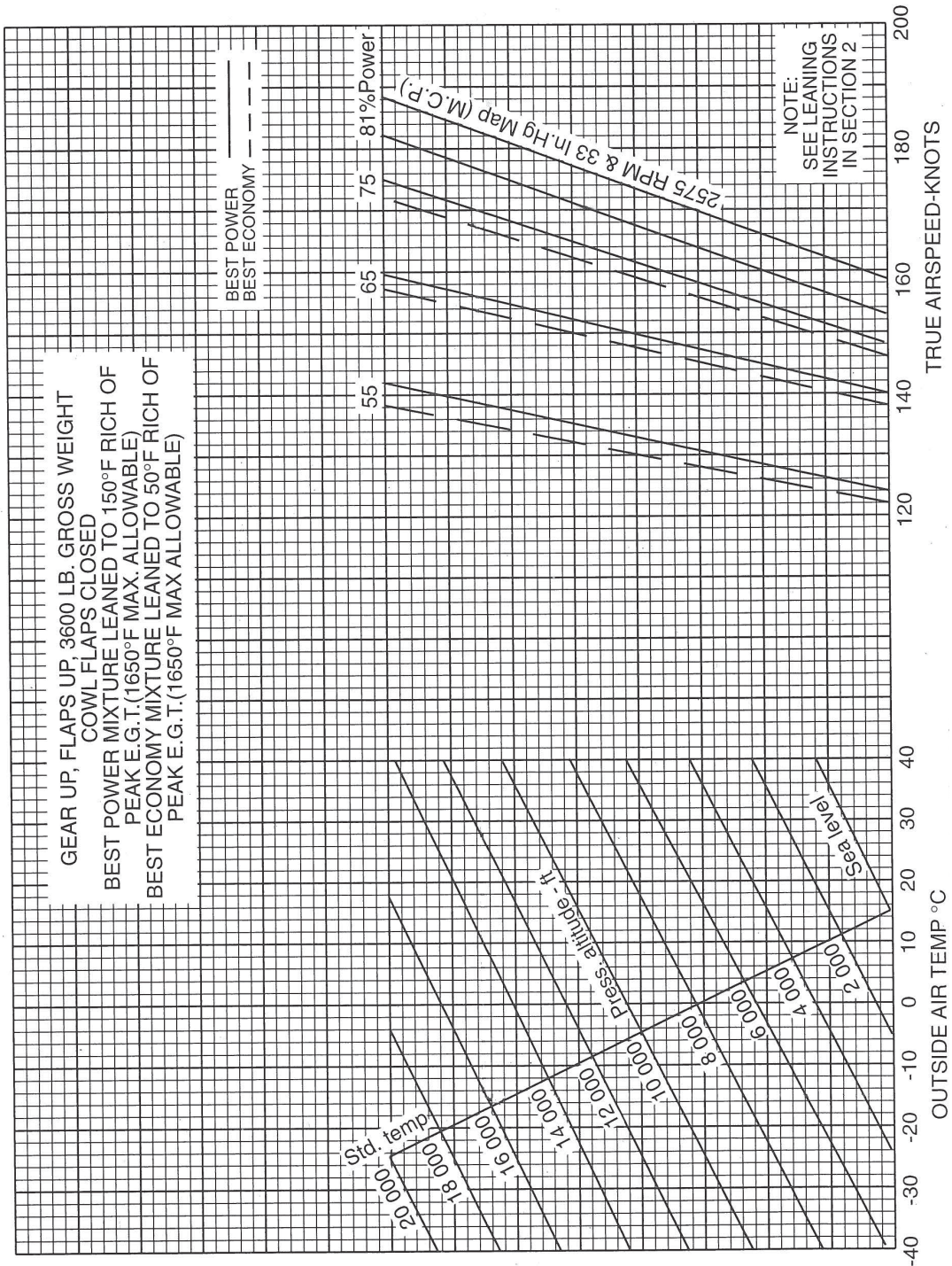


- (b) Additional unexpected luggage is now required to be carried. If the luggage is to be stored at 90 inches aft datum, calculate the maximum amount that can be carried. (1 mark)

- (c) Given the following data:
- cruise pressure altitude 16 000 ft
  - outside air temperature -15 °C
  - 75% best power,

use the performance chart below to determine cruise TAS and cruise power settings required for best economy. (2 marks)

**PA-32RT Cruise Performance Chart**



See next page

Question 26

(6 marks)

An aircraft is approaching landing and its speed reduces to below stall speed.

- (a) Use a diagram to show the airflow above and below the wing once the aircraft has stalled. Describe the pressure alterations because of the stall. (3 marks)

---

---

---

---

- (b) State **three** ways in which a pilot can identify an approaching stall. (3 marks)

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

**Question 27****(2 marks)**

Using the chart below, calculate the Beginning of daylight time (LMT) on 17 May for the position  $22^{\circ} 35' \text{S}$ ,  $125^{\circ} 25' \text{E}$ . Show **all** workings.

---

---

---

---

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

**See next page**

**Question 28**

**(5 marks)**

Some aircraft are designed with certain stability characteristics for specialised operations.

- (a) Identify **four** ways in which negative longitudinal stability might be incorporated into the design of an aircraft. (4 marks)

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

Four: \_\_\_\_\_

- (b) Outline the concept of a statically-unstable aircraft. (1 mark)

\_\_\_\_\_  
 \_\_\_\_\_

**Question 29**

**(4 marks)**

Positive and negative acceleration forces (G-forces) can have a significant effect on the human body. Outline **four** effects the human body can experience as a result of these forces.

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

Four: \_\_\_\_\_



**Question 30**

**(8 marks)**

Understanding the different ways in which clouds form is essential to the safety of aviation operations. Explain the processes involved in cloud formation in relation to the following terms.

(a) Convection

(3 marks)

---

---

---

---

---

---

---

(b) Mechanical turbulence

(5 marks)

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

Question 31

(7 marks)

Using the scenario below, identify **four** threats and **three** errors.

A commercial pilot plans a flight from Aerodrome A to Aerodrome B. Due to passengers arriving late, the pilot is rushed to arrive at Aerodrome B for a return flight.

Approaching Aerodrome B, the pilot elects to join the non-standard right base runway 14 and not overfly the aerodrome on the basis of an unofficial weather application showing headwind. On approach to landing, the aircraft is not stable, flown at a higher than normal approach speed and experiences tailwind. The pilot elects to continue with the landing and the aircraft touches down late on the short and downward sloping gravel runway. The aircraft overruns the end of the runway and becomes bogged.

The pilot gets out of the aircraft and checks for damage and attempts to contact their company by phone, but there is no phone coverage so the pilot is unable to contact the company. The passengers and pilot elect to push the aircraft back to the runway. As a result, the pilot and passengers elect to return to Aerodrome A and the pilot contacts their company once airborne.

Threats

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

Four: \_\_\_\_\_

Errors

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

**Question 32**

**(6 marks)**

Use the diagram below to demonstrate the effect on the airstream over the aerofoil when the aircraft encounters a normal shock wave at subsonic speed.



**Question 33**

**(8 marks)**

The requirement for instrument flight rules (IFR) pilots to be aware of the aircraft's position at all times is vital to safe aircraft operations. Explain the operating process and state a limitation of the following.

- (a) Inertial Navigation System (INS) (4 marks)

Operating process: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Limitation: \_\_\_\_\_  
\_\_\_\_\_

- (b) Global Positioning System (GPS) (4 marks)

Operating process: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Limitation: \_\_\_\_\_  
\_\_\_\_\_

**Question 34**

**(3 marks)**

Aircraft have an expected life span. Provide **three** considerations for an owner when deciding between extending the life of an existing airframe or purchasing a new aircraft.

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

**Question 35**

**(5 marks)**

Using a flight computer, determine each of the following.

- (a) Identify the required heading and ground speed given a required track of 070° T, true airspeed of 140 kt and wind of 270° T/18 kt. (2 marks)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- (b) How many minutes will it take an aircraft travelling at 140 kt to travel 250 nm? (1 mark)

\_\_\_\_\_

\_\_\_\_\_

- (c) An aircraft uses 25 litres in 40 minutes of flying. Calculate the hourly fuel flow to the nearest half litre. (1 mark)

\_\_\_\_\_

\_\_\_\_\_

- (d) An aircraft is established at a pressure height of 4000 ft, outside air temperature of 15 °C and an indicated airspeed of 135 kt. Calculate the true airspeed. (1 mark)

\_\_\_\_\_

\_\_\_\_\_

**Question 36****(5 marks)**

An aircraft has travelled 100 nm on a heading of 090° M and a position fix has been established 7 nm north of the planned track.

- (a) Using the 1 in 60 rule, identify to the nearest degree the track error. Show **all** workings. (2 marks)

---

---

---

---

The final destination is a further 150 nm from the aircraft's present position.

- (b) Use the 1 in 60 rule to identify the required closing angle and new required heading. Complete all answers to the nearest degree and show **all** workings. (3 marks)

---

---

---

---

---

---

**See next page**

Question 37

(12 marks)

Vision is critical to a pilot’s situational awareness as well as their ability to make command decisions.

- (a) Describe the following eye deficiencies and state their effect on the pilot experiencing the condition. (4 marks)

Eye deficiency	Description	Effect on a pilot
Hypermetropia	_____	_____
	_____	_____
	_____	_____
Astigmatism	_____	_____
	_____	_____
	_____	_____

- (b) Identify **three** characteristics of the following optical illusions experienced by a pilot and state how their impact can be reduced.

- (i) Empty field myopia (4 marks)

Characteristics

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

Reduced impact

\_\_\_\_\_

\_\_\_\_\_

- (ii) Autokinesis (4 marks)

Characteristics

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

Reduced impact

\_\_\_\_\_

\_\_\_\_\_

**Question 38****(4 marks)**

Alcohol can have a significant effect on the human body, resulting in impaired performance by flight crew. Identify **four** effects of alcohol consumption that are detrimental to flight crew performance.

One: \_\_\_\_\_

Two: \_\_\_\_\_

Three: \_\_\_\_\_

Four: \_\_\_\_\_

**Question 39****(2 marks)**

When a helicopter transitions from a hover to forward flight, an aerodynamic phenomenon occurs.

(a) What is this aerodynamic change called? (1 mark)

\_\_\_\_\_  
\_\_\_\_\_

(b) State why this change occurs. (1 mark)

\_\_\_\_\_  
\_\_\_\_\_

**Question 40**

**(4 marks)**

(a) With the aid of a diagram, explain what is meant by 'coning' in relation to helicopters.

(2 marks)

---

---

---

(b) Explain the meaning of the expression 'hovering in the dead man's zone', when applied to helicopter operations.

(2 marks)

---

---

---

---



**Question 41****(7 marks)**

A propeller-driven, piston-engined aircraft with a constant speed propeller is at top of climb and the pilot commences establishing cruise performance.

- (a) Explain the sequence of actions or the process of controls the pilot undertakes to establish cruise power settings. (4 marks)

---

---

---

---

---

---

---

---

---

---

- (b) When completing the actions identified in part (a), state which instrument is affected by each control. (3 marks)

Control	Instrument affected by control

**Question 42**

**(8 marks)**

Aircraft are designed with many different propulsion systems, depending on their desired purpose and performance.

(a) Explain the operation of a turbojet engine.

**(6 marks)**

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

(b) Describe the difference between a turbojet and a turboprop engine.

**(2 marks)**

---

---

---

---











## ACKNOWLEDGEMENTS

- Question 22** Adapted from: Bureau of Meteorology. (2017). *Graphical area forecast SFC – 10000FT VIC* [Chart]. Retrieved May, 2021, from <http://www.bom.gov.au/aviation/data/education/gaf-poster.pdf>
- Question 25(c)** Chart from: Yeo, M., Bowers, G., & Bennett, K., (2001). Chart L: Cruise performance chart. *Handbook of flight* (2nd ed.). WestOne Services, p. 170.  
Not for operational purposes.
- Question 27** Chart adapted from: Airservices Australia. (2017) Time of first light [Chart]. *Aeronautical information package (AIP) Australia* (Gen 2.7-4, issue date 25 Mar 2021). Airservices Australia. Retrieved May, 2021, from [http://airservicesaustralia.com/aip/current/aip/general\\_25MAR2021.pdf](http://airservicesaustralia.com/aip/current/aip/general_25MAR2021.pdf)  
This work contains aeronautical information and data which is © Airservices Australia 2021. No part of this work may be reproduced in any form or by any means without the prior written consent of Airservices Australia. Airservices Australia does not guarantee that the aeronautical information and data is current or free from errors, and disclaims all warranties in relation to its quality, performance or suitability for any purpose. Not for operational use. All rights reserved.

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 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 School Curriculum and Standards 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.