							Question and response book
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# **Aerospace Systems**

#### Time allowed

- Perusal time 10 minutes
- Working time 120 minutes

#### **General instructions**

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- QCAA-approved flight calculator permitted.

 $\mathbf{Q}$ 

- Protractor and ruler or plotter required.
- QCAA formula and data book provided.
- Planning paper will not be marked.

# Section 1 (10 marks)

• 10 multiple choice questions

# Section 2 (70 marks)

• 13 short response questions



# DO NOT WRITE ON THIS PAGE

THIS PAGE WILL NOT BE MARKED

# Section 1

#### Instructions

- Choose the best answer for Questions 1–10.
- This section has 10 questions and is worth 10 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	А	В	С	D
Example:		$\bigcirc$	$\bigcirc$	$\bigcirc$

	٨	D	C	D
	A	В	C	D
1.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
2.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
3.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
4.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
5.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
6.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
7.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
8.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
9.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$
10.	$\bigcirc$	$\bigcirc$	$\bigcirc$	$\bigcirc$

# Section 2

#### Instructions

- Write using black or blue pen.
- If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page ...
  - If you do not do this, your original response will be marked.
- This section has 13 questions and is worth 70 marks.

## **QUESTION 11 (4 marks)**

A VFR aircraft is leaving an airport with an airfield elevation of 21 ft. Use the terminal area forecast (TAF) to identify the outside air temperature and QNH at 03UTC. Determine the pressure altitude and density altitude.

TAF YHOT 022230Z 0300/0312 28015KT 9999 SCT050CB T 21 24 28 28 Q 1009 1007 1009 1010

#### **QUESTION 12 (6 marks)**

Identify six vision issues that affect human performance in aerospace contexts.

1.	
2.	
3.	
4.	
5.	
6.	

#### **QUESTION 13 (3 marks)**

Identify the preferred engine type for medium- and long-range passenger airliners. Provide two reasons why this engine is preferred.

# QUESTION 14 (5 marks)

A pilot is chartered to fly a Saab 340 twin-engine turboprop aircraft from Adelaide to Coober Pedy, departing at 9:30 am. The Saab 340 has a tyre pressure of 120 PSI and a wingspan of 21.44 m.

COOBER PEDY AVFAX CODE 5201				ELEV 745
1428 - BB	SA 290224S AD OPR District 5723 ARO 0400 Council PH 08 86	1344315E Council of Coober 108 230: 0418 844 672 4600.	UTC +9:30 VAR 6 DEC Pedy, PO Box 593. OPS MC	YCBP G E CERT 425, Coober Pedy, SA, GR 0418 848 279.
REMARKS 1. AD Charges - All ACFT 2. This AD is a Security C HANDLING SERVICES AND VIVA Energy Aviation - Under 48HR prior arrangement - ca AVGAS H24 swipe bowser - all credit cards). JET A1 bowser (operator call PASSENGER FACILITIES WC/HC (PH 0417 805 891)/L METEOROLOGICAL INFOR 1. TAF CAT D, METAR/2 2. AWIS PH 08 8150 38 2. AWIS FEEC 122 125	<sup>5</sup> \$14/1,000KG MNM ontrolled Airport. <b>D FACILITIES</b> rground Books: MOI ll-out fee \$165. PH ( accepts Viva Fuel2S l-out RQ at all times) <b>CATION PROVIDE</b> SPECI. 303 - Report faults to	1 \$14. Helicopter \$ N-FRI 0800-1700 I 0428 829 795. Sky card, V, MC an ). <b>:D</b> D BoM.	14/landing. ocal. Weekend id debit card (p	ls, AH and PH by in number RQ for
3. AWIS FREQ 122.125 PHYSICAL CHARACTERIS 04/22 043 47a 14/32 145 27c AERODROME AND APPRO RWY 04/22 LIRL RWY 04/22 PTBL(1) RWY 14/32 PTBL(1) (1) EMERG only RWY edge light spacing: 04/2 OTHER LIGHTING TWY LGT: Blue edge. ATS COMMUNICATIONS EA	5 - Report faults to A TICS PCN 8 /F /A /870 (1 5700/520 (75PSI) G ACH LIGHTING PAL 119.6 22: 90M.	D OPR (requires o 26PSI) /U Gravel. Unrated	WID 30 WID 30 WID 30	se to activate). RWS 150 RWS 90
<ul> <li>FIA MELBOURNE CENT</li> <li>RADIO NAVIGATION AND L</li> <li>NDB CBP 341 2901</li> <li>(1) Pilot monitored.</li> <li>LOCAL TRAFFIC REGULAT</li> <li>1. All ACFT ABV 3,000k</li> <li>2. PRKG restrictions for Manager on at least 4</li> <li>CTAF - AFRU 126.7</li> <li>ADDITIONAL INFORMATIO</li> <li>1. Gliding and recreation</li> <li>2. Winch launching and</li> <li>3. Warning: Kangaroo a</li> <li>4. Ultralight OPS and tra</li> </ul>	RE 120.7 7 ANDING AIDS 54.5S 134432 FIONS G to turn at turning non RPT aircraft or 48 HR PN. N nal ACFT OPS. aero-tow for glider of and bird hazards exist aining.	7000FT 25.6E Range nodes only, using n sealed apron are OPS. st.	50 (HN 50) MAX RAD turr a. Permit obtai	(1) is. nable FM AD

Use the ERSA extract on the previous page to:

a) identify runway lengths and a potential hazard

b) determine the most appropriate runway for landing and take-off for the aircraft and explain your reasoning.

[2 marks]

[3 marks]

## **QUESTION 15 (4 marks)**

A Boeing 787 aircraft is required to maintain altitude at 7500 ft in a holding pattern after a 16-hour international flight. ATC has informed the captain and first officer that there is some delay due to localised thunderstorms at the airport with no certainty of opening. After 10 minutes in the holding pattern, the captain realises that the aircraft is critically low on fuel due to unexpected headwinds.

Identify three factors adversely affecting situational awareness in this scenario and explain how one factor would lead to poor decision-making.

#### **QUESTION 16 (5 marks)**

Explain the purpose of an instrument landing system (ILS) and how it operates. Use sketches to support your explanation in the space provided.

**Note:** If you make a mistake in the sketch, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this question and response book.

## **QUESTION 17 (6 marks)**

A pilot is planning a return scenic flight with two passengers from Alice Springs to Uluru with a true course of 233° and a distance of 181 NM. The aircraft is planned to depart at 0100 UTC and will maintain a cruising altitude of 7500 ft. The passengers have requested a 30-minute scenic flight around Uluru and Kata Tjuta, where the aircraft will descend and maintain an altitude of 4500 ft.

The magnetic variation in the region is 4° E and the area forecast wind is 180/08 for all levels. ATC has advised that helicopters and drones operate around the landmarks. Data for the aircraft and landmark chart is provided.

#### CESSNA C182RG

- TAS = 145 kts
- MTOW = 1409 kg
- Usable fuel = 334 L
- Fuel rate = 50 L per hour

#### Landmark chart excerpt

- Drone maximum altitude law = 400 ft
- Helicopter altitude = 3500 ft
- Fixed wing altitude = 4500 ft
  - a) Analyse the data and determine the estimated time en route.

[3 marks]

b)	Explain a limitation of traffic collision avoidance systems (TCAS) in this scenario.	[1 m
c)	Determine the level of risk of a mid-air collision during the scenic flight and provide an example to support your decision.	[2 ma

**9** of 25

#### QUESTION 18 (5 marks)

During a flight heading west through dusty conditions, the pilot notices a problem with the ASI instrument. The pilot completes a controlled descent and climb manoeuvre, where both the altimeter and vertical speed indicator were observed and behaved as intended. However, during the manoeuvre there was an indication of airspeed decreasing to 135 kts during the descent and an indication of airspeed increasing to 155 kts during a controlled climb.



Analyse the six flight instruments to determine the cause of the problem.

|--|

#### **QUESTION 19 (8 marks)**

During a hot summer, a solo pilot planned a flight from Walgett (YWLG) to Bourke (YBKE) departing at 2330 UTC. The pilot completed a 6-hour flight beforehand with a short coffee break between the flights.

After flying 42 NM, they found they were 13 NM off track to the right. En route, they noticed their ground speed was slower than planned and calculated that 0100 UTC was their new ETA. After looking at their flight plan and fuel log, the pilot believed it was safe to continue the flight.

- Wind =  $330^{\circ}/20$
- TAS = 125 kts
- Usable fuel = 120 L
- Fuel rate = 40 L per hour
- Magnetic variation =  $10^{\circ}$  E
- Taxi fuel = 7 L at YWLG and YBKE
- Cruise altitude will be reached while on track
- Climb fuel and time are assumed as part of cruise fuel and time
- Regulatory requirements for fixed fuel reserve is 45 mins of flight time
  - a) Use the data provided to complete the fuel log forms. Include track error, track made good, closing angle and a new heading to fly to YBKE in the space provided.

[5 marks]

	NAV/COMM LOG										
	LSALT	ALT	TAS	TR (m)	WIND	HDG	G/S	DIST	ETI	EET	PLN EST
YWLG											
YBKE	1536		125	261				113			

Fuel	Min	Litres
Climb		
Cruise		
Alternate		
Sub-total		
VRB RES (15%)		
Fixed RES (45 min)	45	

Fuel		Min	Litres
Holding	Inter 30 min		
Tioluling	Tempo 60 min		
Taxi			14
Fuel req	uired		
Fuel man	rgin		
Enduran	ce		

**Note:** If you make a mistake in the fuel log forms, cancel it by ruling a single diagonal line through your work and use the additional response space on page 25 of this question and response book.



Do not	write outside this box.	

#### **QUESTION 20 (5 marks)**

Refer to the visual terminal chart (VTC) in the stimulus book.

A pilot is planning a skydiving flight with four passengers from Hobart to the drop zone at Buxton Point, overflying Triabunna airfield in a GA aircraft (TAS 150 knots). The magnetic variation in the region is 15°E and the area forecast indicates that the winds are 230/14 at all levels up to FL140. The skydivers will jump from 10 000 ft.

a) Use the VTC to complete the flight plan.

NAV/COMM LOG										
	LSALT	ALT	TAS	TR (m)	WIND	HDG	G/S	DIST	ETI	
Hobart (HBA)										
Triabunna (TNA)			150 kt					26		
Buxton Point (BP)			150 kt					16		

**Note:** If you make a mistake in the flight plan, cancel it by ruling a single diagonal line through your work and use the additional response space on page 25 of this question and response book.

b) State where the aircraft departs controlled airspace.

[1 mark]

[4 marks]

# QUESTION 21 (6 marks)

An air traffic controller forgets an aircraft is present on approach and clears another aircraft to enter the active runway in its path, resulting in a runway incursion. Explain three factors affecting situational awareness. Provide two examples of how this risk could have been mitigated.

#### **QUESTION 22 (5 marks)**

Pilot performance is reduced by blood alcohol concentrations as low as 0.025%, with serious errors committed by pilots with a BAC above 0.04%.

a) Determine two variables that will increase a pilot's blood alcohol concentration level. [2 marks]

[3 marks]

b) Identify three organs crucial to flying and explain the impact each organ has on pilot performance when alcohol concentrations exceed 0.04%.

## QUESTION 23 (8 marks)

An aircraft carrying four passengers was attempting to land on RWY27 at Rottnest Island when it failed to stop in time and ran off the end of the runway. When interviewed by airport management, the passengers made statements such as 'we had a lot of luggage, but we took off fine', 'the weather took a turn without warning', 'the pilot looked drained and tense' and 'the young pilot froze up and no-one told us what to do after the aircraft stopped'.

Determine the circumstances that led to the runway excursion and define situational awareness. In your response, discuss crew resource management and three factors affecting the pilot's situational awareness.

Write the question number you are responding to.

ADDITIONAL PAGE	FOR	<b>STUDENT</b>	RESPONSES
		N I O D III ( I	

Write the question number you are responding to.

## ADDITIONAL RESPONSE SPACE FOR QUESTION 19a)

If you want these fuel log forms to be marked, rule a single diagonal line through the fuel log forms on page 12.

NAV/COMM LOG											
	LSALT	ALT	TAS	TR (m)	WIND	HDG	G/S	DIST	ETI	EET	PLN EST
YWLG											
YBKE	1536		125	261				113			

Fuel	Min	Litres
Climb		
Cruise		
Alternate		
Sub-total		
*VRB RES (15%)		
*Fixed RES (45 min)	45	

Fuel		Min	Litres		
Holding	Inter 30 min				
	Tempo 60 min				
Taxi			14		
Fuel req	uired				
Fuel man	rgin				
Enduran	ce				

## **ADDITIONAL RESPONSE SPACE FOR QUESTION 20a)**

If you want this flight plan to be marked, rule a single diagonal line through the flight plan on page 15.

NAV/COMM LOG									
	LSALT	ALT	TAS	TR (m)	WIND	HDG	G/S	DIST	ETI
Hobart (HBA)									
Triabunna (TNA)			150 kt					26	
Buxton Point (BP)			150 kt					16	

# References

#### **Question 14**

Airservices Australia, 'Aeronautical information package — En Route Supplement Australia (ERSA)' Coober Pedy, www.airservicesaustralia.com/aip/current/ersa/FAC\_YCBP\_27FEB2020.pdf. This work contains aeronautical information and data which is © Airservices Australia 2019. 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. Used by QCAA with permission.

#### **Question 18**

Adapted from 2019, 'Complete set for any aircraft', *RealityXP*, https://reality-xp.com/flightsim/flt/ features/index.html

#### **Question 19**

Adapted from CASA 2023, 'Flight planning notepad', *Australian Government Civil Aviation Safety Authority*, https://shop.casa.gov.au/products/flight-planning-notepad-flight-planning-notepad

#### **Question 20**

Adapted from CASA 2023, 'Flight planning notepad', *Australian Government Civil Aviation Safety Authority*, https://shop.casa.gov.au/products/flight-planning-notepad-flight-planning-notepad

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