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

AVIATION

ATAR course examination 2019

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

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2020/1423
Web Version of 2019/62473

Section One: Multiple-choice **20% (20 Marks)**

Question	Answer
1	a
2	b
3	a
4	d
5	d
6	c
7	b
8	a
9	d
10	a
11	b
12	a
13	b
14	c
15	c
16	a
17	b
18	d
19	b
20	d

Section Two: Short answer **80% (125 Marks)**

Question 21 **(4 marks)**

There are two types of stability considered to act in all directions on an aircraft. Name and outline each of them.

Description	Marks
Two marks for each stability type. One mark for name. One mark for outline.	
Static stability is the initial tendency of an aircraft to return to its original position when it's disturbed	1–2
Dynamic stability is how an airplane responds over time to a disturbance	1–2
Total	**4**

Question 22 **(4 marks)**

As part of their normal operational duties, pilots employ countermeasures to keep threats, errors and undesired aircraft states (UAS) from reducing margins of safety in flight operations.

List **two** countermeasures pilots employ and outline the reason why each is used.

Description	Marks
One mark for each countermeasure. Answers could include: Checklists / briefings / call-outs / SOPs / Personal strategies and tactics.	1–2
One mark for each reason. Answers could include: Anticipating threats and consequences / Weighting options to reduce, counter or avoid threats / Making safe decisions / Detecting, reporting and correcting errors / Intervening or recovering from undesired aircraft states (UAS) / Practising recovery techniques for UAS.	1–2
Total	**4**
Accept other relevant answers	

Question 23 **(2 marks)**

State the purpose of speed brakes and the effect they have on the aerodynamics of an aircraft.

Description	Marks
A device that quickly that slows an aircraft down, helps lose altitude quickly, or for tactical manoeuvres	1
Effect is increase drag and/or reduce lift	1
Total	**2**

Question 24 **(6 marks)**

Situational awareness (SA) requires the pilot to be switched-on to an existing situation and to be focused on what is happening. Describe how the following **three** areas encompass SA.

Description	Marks
Two marks for each area. Description to include an outline of the area awareness (1) and a relevant focus (1) that a pilot could use.	
Geographic awareness - Where are we? Where are we going? Where have we been? Where is the nearest diversion aerodrome? Where is home base?	1–2
Climatic awareness - Weather, visibility, cloud base, forecast, holding, alternates	1–2
Self awareness – Fitness, health, fatigue, recent experience, skill, level of stress	1–2
Total	**6**
Accept other relevant answers	

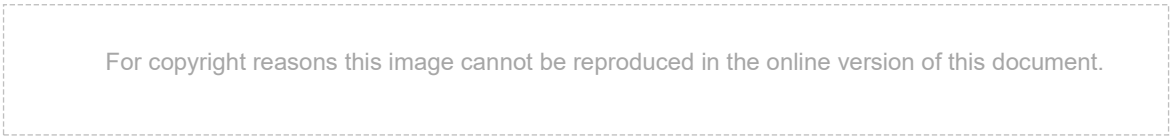
Question 25 **(3 marks)**

List **three** methods a pilot can use to avoid air sickness while flying.

Description	Marks
One mark for each method	
Answers could include: • anticipate and avoid turbulence • fly the airplane smoothly and gently and maintain trim and balance • focus on the horizon as much as you can • avoid manoeuvres involving unusual g-forces • ventilate the cabin with a good supply of cool, fresh air.	1–3
Total	**3**
Accept other relevant answers	

Question 26 **(5 marks)**

(a) Label the diagram below to show the disposition of the forces acting on an aircraft in a **climb** with power during take-off. (4 marks)



Description	Marks
Correctly labels	
thrust	1
lift	1
drag	1
weight.	1
Total	**4**

(b) What could be fitted to the leading edges of the above aircraft's wing to reduce take-off speed and improve the rate of climb? (1 mark)

Description	Marks
Vortex generators	1
Total	**1**
Accept other relevant responses	

Question 27 **(3 marks)**

(a) Explain how you could treat hyperventilation. (2 marks)

Description	Marks
Explains that you are trying to slow down the breathing rate	1
by any of the following methods: • breathe into a paper bag • calm the person • encourage them to talk normally • allocate a simple distracting task.	1
Total	**2**
Accept other relevant responses	

(b) In treating hyperventilation, what are you trying to do to the level of carbon dioxide in the pilot's blood? (1 mark)

Description	Marks
You are trying to increase the carbon dioxide levels in the blood	1
Total	**1**

Question 28 **(6 marks)**

(a) What has to occur in order for the aircraft to stall (point B)? (2 marks)

Description	Marks
Aircraft exceeds its given critical angle of attack or similar explanation	1
Aircraft is no longer able to produce the required lift for normal flight	1
Total	**2**

(b) State the **four-step** procedure to recover from the spin (point C). (4 marks)

Description	Marks
Step 1 – Power to idle	1
Step 2 – Ailerons to neutral	1
Step 3 – Rudder opposite spin	1
Step 4 – Elevator forward	1
Total	**4**
Accept other relevant responses	

Question 29 **(5 marks)**

(a) (i) Circle the colour(s) that are associated with colour blindness. (1 mark)

red orange yellow green blue indigo violet

Description	Marks
Circles both red and green only	1
Total	**1**

(ii) Identify **two** difficulties that a pilot with colour blindness can encounter in flying operations. (2 marks)

Description	Marks
One mark for each difficulty	
Answers could include: • night flying • low/poor visibility • red/green navigation lights on other aircraft • red/green taxiway lights • observing threshold lighting • visual light signals from tower (used in a radio failure situation instead of radio voice message) • chart reading • lights inside cockpit.	1–2
Total	**2**
Accept other relevant answers	

(b) Explain why myopia is a problem for a pilot if uncorrected. (2 marks)

Description	Marks
Explains why myopia is a problem	2
States some information about myopia	1
Total	**2**
Example of a two mark response: If a pilot is nearsighted, they will have trouble reading runway signs and seeing distant, such as aircraft approaching. The pilot will have the ability to see well for close-up tasks such as reading and computer use. Other signs and symptoms of myopia include squinting, eyestrain and headaches. It can be corrected by wearing glasses or contact lenses.	
Accept other relevant answers	

Question 30 **(3 marks)**

A precision approach path indicator (PAPI) is a visual aid that helps a pilot maintain the correct approach to a runway. Complete the table below identifying what each light array colours indicate about glide slope trajectory.

Description		Marks
four white lights	The glide slope of the plane is too high	1
two red lights and two white lights	The glide slope of the plane is on the correct approach	1
four red lights	The glide slope of the plane is too low	1
	Total	**3**

Question 31 **(2 marks)**

Given the following data:
- airfield elevation 1218 ft
- QNH 1004 hPa
- OAT 33 °C.

Calculate airfield pressure height. Show **all** workings.

Description	Marks
(ISA QNH – Actual QNH) x 30 ft + Elevation	
(1013 – 1004) x 30 ft + Elevation 1218 ft	1
270 + 1218 ft =	
1488 ft	1
Total	**2**

Question 32 **(2 marks)**

Given the following data:
- airfield pressure height 1345 ft
- QNH 1025 hPa
- OAT 10 °C.

Calculate airfield density altitude. Show **all** workings.

Description	Marks
(ISA temperature Deviation x 120 ft) + PA = DA	
(10 °C – 12 °C) x 120 ft + PA 1345 ft = DA	1
2 °C x 120 ft + PA 1345 ft = DA	
–240ft + 1345 ft =	
1105 ft	1
Total	**2**
Allow one mark if showed working but mathematical error	

Question 33 **(3 marks)**

An aerodrome's latest weather information states the dewpoint as 10 °C and the temperature as 22 °C. The aerodrome elevation is 132 ft. Using the dry adiabatic lapse rate, calculate the cloud base above sea level. Show **all** workings.

Description	Marks
Applies correct lapse rate (22 – 10) ÷ 3 = 4	1
4 x 1000 = 4000 ft above aerodrome level	1
4000 + 132 = 4132 ft	1
Total	**3**
Allow one mark if showed working but mathematical error	

Question 34 **(4 marks)**

(a) Explain the method of operation of the inertial navigation system (INS) on an aircraft. (3 marks)

Description	Marks
Initially known aircraft location is input as a reference location	1
Computer, accelerometers and gyroscopes are used to calculate using dead reckoning the position of the aircraft	1
Can have additional inputs from airspeed indicators and radio navigation aids	1
Total	**3**

(b) State the primary limitation of the INS on an aircraft. (1 mark)

Description	Marks
Acceleration and velocity errors cause the position error to become more and more inaccurate without regular input from another navigation system	1
Total	**1**

Question 35 **(5 marks)**

(a) Explain the method of operation of ADSB. (3 marks)

Description	Marks
Aircraft determines position and other required information using satellite	1
Aircraft broadcasts position, altitude and velocity to air traffic control ground station	1
Operation is automatic, requiring no input from pilots or ground station	1
Total	**3**

(b) State **two** limitations on ADSB. (2 marks)

Description	Marks
One mark for each limitation	
Answers could include: • relies on aircraft and/or satellite to provide accurate information • data sent by aircraft is not fully secure and can be sent by multiple parties.	1-2
Total	**2**
Accept other relevant responses	

Question 36 **(4 marks)**

Identify **four** methods by which air is forced to ascend, leading to cloud creation.

Description	Marks
Air warmer than its environment becomes buoyant and rises (convection)	1
Air is forced to flow up and over higher terrain (orographic)	1
Air is forced to rise over frontal surfaces (widespread ascent)	1
Winds converge at low levels	1
Total	**4**

Question 37 **(6 marks)**

(a) What time and date was the TAF issued? (1 mark)

Description	Marks
1018 on the 16th	1
Total	**1**

(b) What was the forecast wind at 1015UTC? (1 mark)

Description	Marks
230° at 18 kt	1
Total	**1**

(c) What is the meaning of the term TEMPO used in the forecast? (1 mark)

Description	Marks
There will be temporary variations (periods of 30 to 60 minutes), to the previously given mean conditions, during the period 1600 to 0100	1
Total	**1**

(d) What is the forecast QNH at 1300UTC? (1 mark)

Description	Marks
1018 (hPa)	1
Total	**1**

€ Outline the forecast cloud at 0220UTC. (2 marks)

Description	Marks
Scattered 4000 ft	1
with periods of broken 1000 ft	1
Total	**2**

Question 38 **(5 marks)**

Explain the method of operation of global navigation systems (GPS).

Description	Marks
One mark for each relevant point. Maximum of 5 marks.	
Explanation could include: • GPS units receive signals from satellites • minimum of three satellites are required to determine a position • time coded signal sent from satellite is interpreted by the receiver • the difference in time between the signal sent and the signal received is used to calculate the range • each satellite has atomic clocks, with master control stations monitoring and managing satellites.	1-5
Total	**5**
Accept other relevant responses	

Question 39 **(5 marks)**

(a) In flight planning, state the purpose of:

(i) area QNH. (1 mark)

Description	Marks
Tells pilot height above mean sea level over an area	1
Total	

(ii) QFE. (1 mark)

Description	Marks
Tells pilot height above aerodrome reference point	1
Total	**1**

(b) Explain the relevance to a pilot in Australia of ‘transition level’. (3 marks)

Description	Marks
Altitude at which pilots change from using QNH to QNE1013 or vice versa	1
In Australia the transition level is 10 000 feet or FL110 and descent	1
Identifies transition level is above mean sea level (AMSL) or 1013 datum	1
Total	**3**

Question 40 **(7 marks)**

(a) What meteorological feature is Veronica? (1 mark)

Description	Marks
(Tropical) cyclone	1
Total	**1**

(b) State **two** features of Veronica. (2 marks)

Description	Marks
Severe low pressure system	1
Gale force winds	1
Total	**2**
Accept other relevant responses	

(c) State the pressure at Position **A**. (1 mark)

Description	Marks
1012 (hPa)	1
Total	**1**

(d) Describe the frontal system approaching the west coast of Tasmania. (3 marks)

Description	Marks
Cold front	1
moving in an easterly direction	1
at 50 kt	1
Total	**3**

Question 41 **(4 marks)**

Aircraft noise has a significant effect on aviation operations. Identify **two** sources of aircraft noise. Outline how each of these sources has been reduced or ways in which it could be reduced.

Description	Marks
One mark per source and one mark per way of reducing the noise. Two mark responses include:	
Mechanical (or engine) noise with high bypass engine reducing noise	1–2
Aerodynamic noise reduced by reducing drag or protruding external surfaces	1–2
Aircraft system noises reduced by designing more efficient and quieter systems	1–2
Total	**4**
Accept other relevant responses	

Question 42 **(5 marks)**

Using a flight computer, calculate:

(a) required magnetic track. (1 mark)

Description	Marks
260° M	1
Total	**1**

(b) aircraft ground speed. (1 mark)

Description	Marks
Between 125 and 128 kt inclusive	1
Total	**1**

(c) direction of aircraft drift. (1 mark)

Description	Marks
Left	1
Total	**1**

(d) required aircraft heading. (1 mark)

Description	Marks
269° M ±1	1
Total	**1**
If error made with required magnetic heading part (a), mark awarded if correct based on previous error	

(e) aircraft drift angle. (1 mark)

Description	Marks
9° ±1	1
Total	**1**

Question 43 **(3 marks)**

Use the Performance Chart provided on page 19 to calculate the maximum take-off weight for a Piper PA-32RT-300T Turbo Lance under the stated conditions. Show **all** workings on the chart provided.

Conditions	
Pressure height	4000 ft
Temperature	14 °C
Wind	12 kt HW
Slope	2% up
Take-off distance available	1000 m
Surface	Hard sealed

Description	Marks
Workings on the chart are correct without error	2
Workings on the chart are correct with minor error	1
Maximum take-off weight = 1340 kg ±20	1
Total	**3**

Question 44 **(2 marks)**

Anti-icing systems are an important feature on many aircraft. List **two** aircraft surfaces that are typically part of the anti-icing system.

Description	Marks
One mark for each correct surface	
Answers could include: • leading edges (wings, props) • engine intakes • rotor blades.	1–2
Total	**2**
Accept other relevant responses.	

Question 45 **(5 marks)**

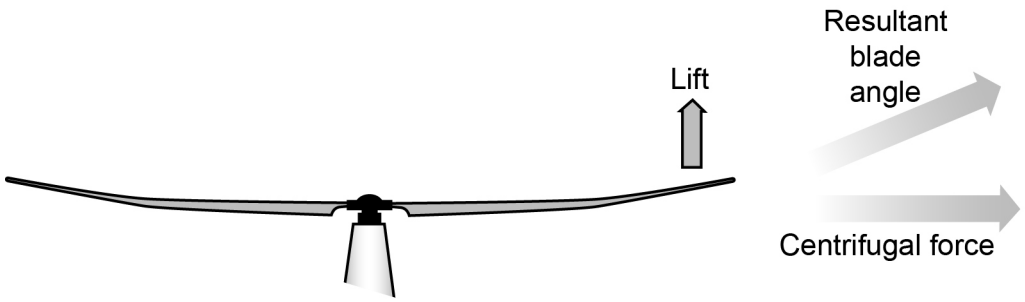
In aviation, V-speeds are standard terms used to define airspeeds important or useful to the operation of all aircraft. Name the following V-speeds.

Description	Marks
Vno – Normal operating speed	1
Va – Maximum manoeuvring speed	1
Vb – Turbulence penetration speed	1
Vfo – Flap operating speed	1
Vs – Stall speed	1
Total	**5**

Question 46 **(8 marks)**

(a) On the diagram above, draw labelled arrows to show the forces that act on the rotor blade. (2 marks)

Description	Marks
Diagram shows:	
an arrow upwards and is labelled lift	1
an arrow to the right and is labelled centrifugal force.	1
Total	**2**
Note: Resultant blade angle can be show but is not required.	



(b) State **three** factors that influence the amount of coning. (3 marks)

Description	Marks
Revolutions per minute (RPM)	1
Gross weight	1
G-forces experienced during the flight	1
Total	**3**

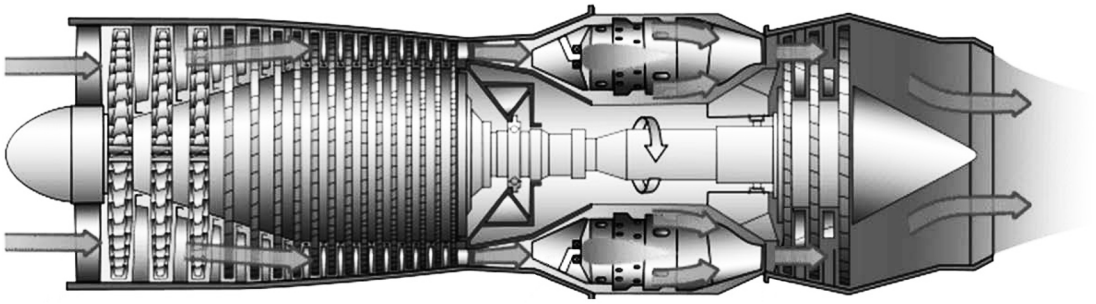
(c) Explain the effects of excessive coning. (3 marks)

Description	Marks
Excessive coning can cause:	
undesirable stresses on the blade	1
a decrease of total lift	1
a decrease in effective disk area.	1
Total	**3**
Accept other relevant responses	

Question 47 **(8 marks)**

Using the diagram below, name and describe the events associated with each of the four stages of the turbine engine.

Intake Compression Combustion Exhaust



Description		Marks
Stage	**Name and description**	
A	Intake - Air is guided into the engine and forced through the inlet.	1–2
B	Compression - A series of fans called the compressor squeezes the air (increases its pressure) by about eight times, and this also increases its temperature.	1–2
C	Combustion - In the combustion chamber, just behind the compressor, the fuel mixes with the compressed air and burns fiercely, giving off hot exhaust gases and producing a huge increase in temperature and pressure.	1–2
D	Exhaust - The hot exhaust gases exit via the turbines (which drives the compressor) through a tapering exhaust nozzle, which helps to accelerate the gases to a high velocity, (so the hot air leaving the engine at the back is traveling several times the speed of the air entering it at the front - and that is what provides the thrust).	1–2
	Total	**8**
Accept other relevant descriptions		

Question 48 **(6 marks)**

Air traffic congestion is one factor limiting expansion of the aviation industry. Discuss the reasons for worldwide congestion, giving **one** specific reason for the United States and **two** for Europe.

Description	Marks
One mark for each stated congestion	
US: outdated air traffic system resulting in poor efficiencies in the air traffic system or other plausible answer.	1
Europe: states multiple air traffic services providers resulting in either difficulties with air routes, coordination, increased cost, lack of harmonisation, lack of central air flow management system or other plausible answer.	1–2
One mark for each reason discussed	
Answers could include: • insufficient runways reducing capacity for aircraft to land • insufficient aerodrome infrastructure (including taxiways/high speed taxiways, bays, or layout) resulting in not enough space for aircraft requiring them • demand during peak periods exceeding the capacity of the aerodromes or air route • aircraft of varying weight classes reduces the capacity of the aerodrome as greater separation is required between weight classes • different aircraft speed or performance results in reduced capacity as aircraft fly different speeds or climb and descend on different profiles • environmental considerations (or noise abatement procedures) results in curfew or procedures being developed which reduce airport capacity.	1–3
Total	**6**
Accept other relevant responses	

ACKNOWLEDGEMENTS

Question 26 Hartley, A. (2016, September 29). Beginner's Series: Four Forces of Flight [Image]. Retrieved, 2019, May from https://smartflighttraining.com/beginners-series-four-forces-flight

Question 47 Diagram adapted from: Dahl, J. (2008). Jet engine numbered.svg [Image]. In *Wikipedia*. Retrieved May, 2019, from https://en.wikipedia.org/wiki/File:Jet_engine_numbered.svg
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Woodford, C. (2019, 1 July). *Jet engines*. Retrieved September, 2019 from https://www.explainthatstuff.com/jetengine.html

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Published by the School Curriculum and Standards Authority of Western Australia
303 Sevenoaks Street
CANNINGTON WA 6107