



## Western Australian Certificate of Education Examination, 2010

### Question/Answer Booklet

# AVIATION

## Stage 2

Please place your student identification label in this box

Student Number: In figures

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In words

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### Time allowed for this paper

Reading time before commencing work: ten minutes  
Working time for paper: 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  
Aviation Appendices Booklet comprising:  
Appendix A Marble Bar (YMBL) ERSA Extract  
Appendix B Loading System Charlie  
Appendix C Cessna 172 take-off chart  
Appendix D Cessna 172 landing chart

#### *To be provided by the candidate*

Standard items: pens, pencils, eraser, correction fluid/tape, ruler, highlighters  
Special items: non-programmable calculators satisfying the conditions set by the Curriculum Council for this course

### 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 notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

## Structure of the examination

The Aviation examination comprises a written examination worth 80 per cent of the total examination score and a practical examination worth 20 per cent of the total examination score.

## Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of total exam
Section One: Multiple-choice	20	20	30	20	16
Section Two: Short Answer	27	27	120	80	64
<b>Total</b>					80

## Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2010*. 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. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two: Write 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 responses to the specific questions asked and to follow any instructions that are specific to a particular question.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
  - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
  - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

**See next page**

## Section One: Multiple-choice

16% (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. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. 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.

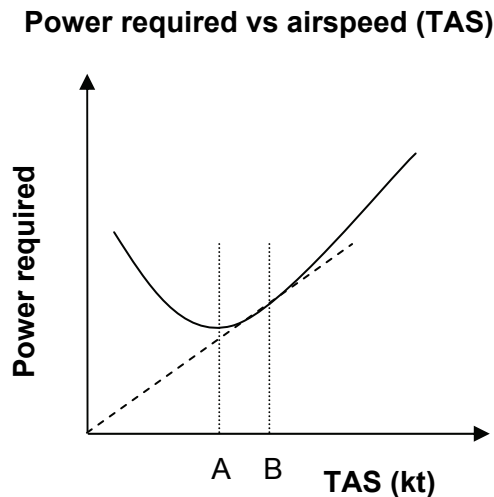
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1. Lift is defined as the component of total reaction acting
  - (a) vertically upward to oppose weight.
  - (b) perpendicular to the chord line.
  - (c) perpendicular to the relative airflow.
  - (d) parallel to the relative airflow.
  
2. An aircraft experiences an increase in headwind component while maintaining a constant airspeed. In this situation, the rate of climb will
  - (a) increase and the angle of climb will remain the same.
  - (b) increase and the angle of climb will increase.
  - (c) decrease and the angle of climb will decrease.
  - (d) remain the same and the angle of climb will increase.
  
3. In relation to the operation of the airspeed indicator (ASI), a high reading is a result of a
  - (a) low total pressure.
  - (b) high static pressure.
  - (c) high atmospheric pressure.
  - (d) high dynamic pressure.
  
4. An impulse coupling is a device used to
  - (a) assist engine start-up.
  - (b) prevent the engine surging when the throttle is advanced.
  - (c) energise the bus bar.
  - (d) prevent electrical interference during radio communications.
  
5. Each cell of an aircraft lead-acid battery is vented to the atmosphere because
  - (a) flammable nitrogen gas is released when the battery is charged.
  - (b) the battery needs air to help keep it cool.
  - (c) flammable hydrogen gas is released when the battery is charged.
  - (d) vapour locks would otherwise occur.

6. VFR lanes of entry are established to provide VFR pilots with safe routes through designated areas while keeping them separate and outside of controlled airspace. This is achieved by
- (a) restricting access to 'commercially licensed pilots'.
  - (b) requiring all aircraft to lodge a flight plan at least 30 minutes prior to the proposed lane entry.
  - (c) establishing directional traffic rules, such as 'keep right'.
  - (d) making all traffic one way only.
7. Under normal circumstances, a fixed-wing aircraft conducting circuits at an uncontrolled aerodrome is not permitted to turn crosswind until it has passed
- (a) 500 feet AMSL.
  - (b) 500 feet AGL.
  - (c) 700 feet AGL.
  - (d) 700 feet AMSL.
8. 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.
9. Dihedral is a design feature that increases
- (a) lateral stability.
  - (b) longitudinal stability.
  - (c) directional stability.
  - (d) normal stability.
10. The term  $V_{FE}$  relates to the speed above which the
- (a) undercarriage should not be lowered.
  - (b) aircraft should not be flown.
  - (c) flaps should not be deployed.
  - (d) controls cannot be fully deflected.
11. An aircraft is maintaining an airspeed of 70 knots in straight and level flight. The angle of bank required to achieve a level rate one turn is closest to
- (a) 7°.
  - (b) 14°.
  - (c) 21°.
  - (d) 10°.

12. Which one of the following flaps increases **both** the camber **and** the area of a wing?
- (a) Fowler flap
  - (b) plain flap
  - (c) split flap
  - (d) slotted flap
13. One noticeable effect of loading an aircraft so that its centre of gravity (C of G) is ahead of the forward limit is that
- (a) longitudinal stability is reduced.
  - (b) there is a greater tendency for the aircraft to stall.
  - (c) it is more difficult for the pilot to recover from a spin.
  - (d) elevator effectiveness is reduced.
14. To which one of the following documents would a pilot refer to obtain information relating to scheduled maintenance?
- (a) certificate of airworthiness
  - (b) maintenance release
  - (c) flight manual
  - (d) aircraft maintenance log book
15. Which one of the following flight profiles should a pilot of a piston-engined aircraft adopt to remain in the air as long as possible for a given amount of fuel (maximum endurance)?
- (a) cruise speed, lean mixture, cruise power
  - (b) climb speed, rich mixture, minimum power
  - (c) best glide speed, lean mixture, minimum power
  - (d) minimum power, lean mixture, minimum safe altitude
16. The component used in the oil pressure gauge to sense pressure is known as the
- (a) bourdon tube.
  - (b) aneroid capsule.
  - (c) capillary bulb.
  - (d) diaphragm.
17. A white flashing light signal from the control tower directed at an aircraft on the ground is an instruction for the pilot to
- (a) take off.
  - (b) stop.
  - (c) return to starting point .
  - (d) taxi to the holding point and call ready for take-off.

18. Refer to the graph below.



The airspeeds A and B, respectively, represent best

- (a) endurance speed and range speed.
  - (b) endurance speed and rate of climb speed.
  - (c) range speed and endurance speed.
  - (d) angle of climb speed and range speed.
19. A pilot observes a high cylinder head temperature (CHT) reading during flight. The appropriate action to remedy the situation would be to
- (a) descend to increase the indicated airspeed.
  - (b) increase power and adopt a higher indicated airspeed.
  - (c) decrease indicated airspeed and enrich the mixture.
  - (d) lean the mixture and increase the indicated airspeed.
20. The time interval, as measured by crankshaft rotation, when the intake valve and exhaust valve are both open is known as valve
- (a) lag.
  - (b) lead.
  - (c) overlap.
  - (d) timing.

**End of Section One**

**See next page**

Section Two: Short answer

64% (80 Marks)

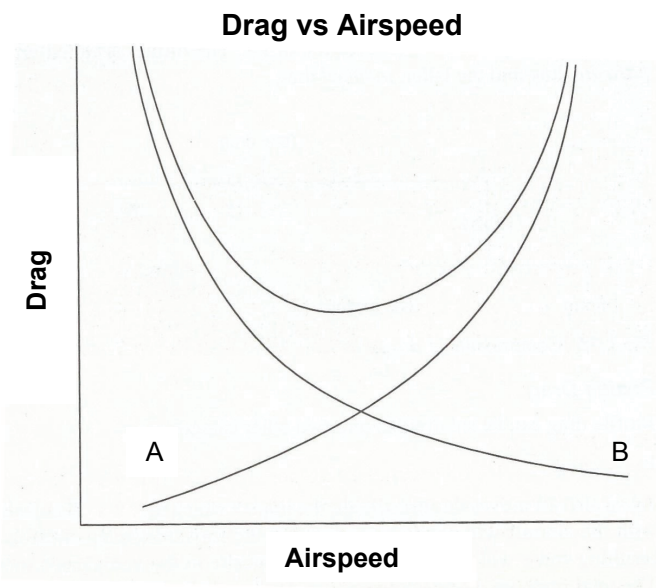
This section has 27 questions. Answer all questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 120 minutes

21. Refer to the graph below. In the spaces provided, label the curves A and B.



(a) A: \_\_\_\_\_ (1 mark)

(b) B: \_\_\_\_\_ (1 mark)

22. During flight, a pilot believes that an aircraft has experienced an electrical failure.

(a) What will the centre-zero ammeter indicate to verify this assumption? (1 mark)

\_\_\_\_\_

(b) Describe **two (2)** actions the pilot could take to rectify and/or minimise the consequences of this failure. (2 marks)

• \_\_\_\_\_

\_\_\_\_\_

• \_\_\_\_\_

\_\_\_\_\_

23. The stall speed for an aircraft in straight and level flight is 60 knots. If the pilot places the aircraft in a 60° angle of bank level turn, determine the

(a) factor by which lift must increase to support the weight of the aircraft; (1 mark)

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(b) new stall speed of this aircraft in this manoeuvre. (2 marks)

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24. The attitude indicator (AI) is important to the safe operation of an aircraft. Explain the principle of operation of the AI. (3 marks)

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25. The Electronic Flight Information System (EFIS) is an important and integral component of jet airliner construction. List **three (3)** ways in which the EFIS contributes to flight safety. (3 marks)

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26. During a constant rate of climb (500 feet/minute) to cruising altitude, the pilot notices that the pitot tube has become blocked and is inoperative. Explain the significance and effect, if any, of this blockage on the operation of the Vertical Speed Indicator (VSI). (2 marks)

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27. The camshaft is an integral component in reciprocating engines.

(a) Describe the function of the camshaft. (1 mark)

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(b) Describe the operation of the camshaft. (2 marks)

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(c) Determine the ratio, in terms of engine revolutions, between the camshaft and the crankshaft. (1 mark)

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28. Turbofan engines, as used on most passenger airliners, are both very powerful and relatively quiet, compared with turbojet engines. Outline **two (2)** features of turbofans that contribute to the above advantages over turbojets. (2 marks)

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

- \_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_

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

- \_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_

31. 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)

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

32. Refer to the Marble Bar (YMBL) ERSA extract. (See **Appendix A**).

The pilot of a single-engined piston aircraft is on the downwind leg for runway 09.  
Derive the following operational information.

(a) What is the circuit direction? (1 mark)

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(b) What altitude should the altimeter read on this leg? (1 mark)

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(c) Which frequency should be selected to activate the aerodrome lighting? (1 mark)

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(d) State **two (2)** conditions that must be met to enable the aircraft to communicate effectively with the FIA 'Melbourne Centre'. (2 marks)

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33. Refer to the Loading System Charlie data provided in **Appendix B**. Use the table provided below to assist you in determining the

- (a) zero fuel weight C of G (mm aft of datum).
- (b) zero fuel weight C of G position in relation to the envelope.
- (c) mm aft of datum of the zero fuel weight compared with the aft limit of the C of G envelope.
- (d) effect of the addition of fuel on the C of G position.

Pilot	60 kg
Co-pilot	65 kg
Passenger	65 kg
Baggage	120 kg
Fuel	141 litres

	Weight (kg)	Moment (kg mm)/100
Empty weight	685	19 206
Oil	7	
Pilot & co-pilot		
Rear Passengers		
Baggage		
Zero Fuel Weight		
Fuel (SG = 0.71)		
Take-off Weight		

(a) Zero fuel weight C of G position (\_\_\_\_\_ mm aft of datum) (2 marks)

(b) Is this zero fuel weight C of G position outside the envelope?

Yes/No \_\_\_\_\_ (1 mark)

(c) Calculate the distance in mm, between the zero fuel weight and the aft limit.

\_\_\_\_\_ mm (1 mark)

(d) What effect does the addition of the 141 litres of fuel have on the C of G position? (2 marks)

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34. On a given day, an aerodrome with an elevation of 4000 feet and QNH of 1002 hPa experiences an ambient (environmental) temperature of +10°C. Calculate the pressure height and density height. In each case, show your working.

(a) pressure height (2 marks)

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Pressure height \_\_\_\_\_

(b) density height (round to nearest whole foot) (2 marks)

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Density height \_\_\_\_\_

35. Light aircraft are fitted with dual ignition systems. State **two (2)** reasons for this design feature. (2 marks)

- \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

36. Some light aircraft utilise fuel injection systems. List **two (2) disadvantages** of these systems compared with carburettors. (2 marks)

- \_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

37. A pilot deploys flaps prior to the stall. Explain why the

(a) onset is quicker. (1 mark)

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

(b) airspeed is less than that experienced during a power-off flapless stall. (2 marks)

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

38. A pilot becomes distracted momentarily during flight. Upon glancing at the instruments, the pilot ascertains that the aircraft is in a very nose-low attitude and both the airspeed and angle of bank are increasing rapidly.

(a) What is the name of this undesirable aircraft state? (1 mark)

\_\_\_\_\_

(b) Outline the actions required of the pilot to return the aircraft to its original altitude. (3 marks)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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39. The Concorde aircraft was equipped with an unconventional control known as an **elevon**. What conventional control surfaces did it replace? (2 marks)

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40. **Frise** ailerons reduce adverse aileron yaw. Explain how this is achieved. Use a diagram to assist your answer. (3 marks)

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41. State **two (2)** differences between a turbocharger and a supercharger. (2 marks)

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42. The development of the jet airliner since the 1950s has significantly influenced the way people travel. With reference to this development, outline **three (3)** reasons why people travel more regularly now than they did during previous decades. (3 marks)

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- \_\_\_\_\_  
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- \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

43. Outline the requirements necessary to **hold** an Australian civilian Aeroplane Student Pilot Licence. (3 marks)

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44. Pilots should consume water regularly when flying for extended periods of time.

- (a) What is the name given to the physiological condition that results when sufficient water is not consumed? (1 mark)

\_\_\_\_\_

\_\_\_\_\_

- (b) List **two (2)** symptoms of this physiological condition. (2 marks)

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

45. Refer to the Cessna 172 take-off chart (**Appendix C**) and to the data given below.

Runway	Temp (°C)	Pressure height (feet)	Take-off distance available (m)	Surface	Slope (%)	Wind (kt)	Take-off weight (kg)
02/20	+40	3000	850m	short dry grass	1% down slope to the north	calm	_____ kg

Determine the

- (a) maximum take-off weight permitted, given the above conditions.

\_\_\_\_\_ kg. (2 marks)

- (b) flap setting required to achieve the above performance.

\_\_\_\_\_ degrees. (1 mark)

46. Refer to the Cessna 172 landing chart (**Appendix D**) and the data given below.

Runway	Temp (°C)	Pressure height (feet)	Landing distance available (m)	Slope (%)	Surface	Wind component (kt)	Landing weight (kg)
03/21	30	2000	2000	level	bitumen	030/10	950 kg

Determine the

(a) minimum landing distance required for this aircraft, given these conditions.

\_\_\_\_\_ metres. (2 marks)

(b) correct approach speed to achieve this minimum landing distance.

\_\_\_\_\_ knots. (1 mark)

47. 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)

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

**End of questions**











## ACKNOWLEDGEMENTS

### Question 18

Graph of Power req. from: Yeo, M., Bowers, G., & Bennett, K., (2001). *Handbook of Flight* (2nd ed.). Perth: WestOne Services.

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