



# Headquarters Air Cadets Examination

Senior Cadet  
33/3 Propulsion  
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1. Use black or dark blue pen, NOT pencil.
2. Mark one answer per question with a cross.
3. If you wish to change an answer, cancel the original mark and mark another single answer.

☒ A selected answer.

☒ A cancelled answer.

Mark:

Name and Initials \_\_\_\_\_

Date of Exam \_\_\_\_\_

Date of Birth \_\_\_\_\_

Squadron/Unit \_\_\_\_\_

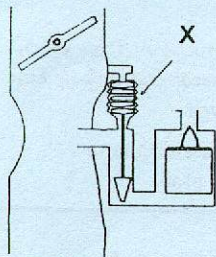
Wing \_\_\_\_\_

1 In a 4-stroke piston engine, what is the force which closes the exhaust and inlet valves?

- a ☐ Suction
- b ☐ Gravity
- c ☐ A pushrod
- d ☐ A spring

2 The arrow X points to a device which is often incorporated into the carburettor of a piston aero engine. What is its function?

- a ☐ Encourages good atomisation of the fuel
- b ☐ Prevents the fuel/air ratio from becoming richer as the throttle valve is opened
- c ☐ Prevents the fuel/air mixture from becoming richer as the aircraft climbs
- d ☐ Supplies extra fuel when needed for acceleration



3 In a magneto, one purpose of the capacitor (condenser) is to:

- a ☐ Reduce erosion at the sparking plug gaps
- b ☐ Make the secondary current flow evenly
- c ☐ Make the primary current flow evenly
- d ☐ Reduce pitting of the contact breaker points

4 What is the purpose of the scavenge pump in the dry-sump lubrication system of a piston engine?

- a ☐ To scavenge contaminants from the oil
- b ☐ To direct oil into the pressure chamber
- c ☐ To transfer oil from the crankcase to the oil tank
- d ☐ To ensure that all engine components are lubricated

5 The function of the turbine in a turbojet engine is to:

- a ☐ Vaporise the fuel as much as possible
- b ☐ Drive the compressor
- c ☐ Drive the gas stream into the atmosphere
- d ☐ Energise the gas stream

6 Which of these is a turbojet engine?

- a ☐ Viper
- b ☐ Pegasus
- c ☐ Spey
- d ☐ Adour

7 Which of these is a turboshaft engine?

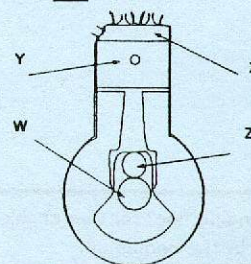
- a ☐ The Lynx Helicopter's Gem
- b ☐ Harrier's Pegasus
- c ☐ Boeing 747's RB211
- d ☐ Concorde's Olympus

8 Which of the following statements applies to the ramjet engine?

- a ☐ It is most efficient at subsonic speeds
- b ☐ It has only one compressor
- c ☐ It has only one turbine
- d ☐ It has no moving parts

9 Four items are labelled on this diagram of a piston engine. Which item (W,X,Y or Z) is the crankshaft main journal?

- a ☐ Z
- b ☐ Y
- c ☐ X
- d ☐ W



10 What characteristic of the piston engine permits the use of such efficiency-enhancing features as valve lead, valve lag and valve overlap:

- a ☐ Its ability to be mounted at any angle
- b ☐ Its wide tolerance of operating temperatures
- c ☐ The ease with which extra cylinders may be added at the design stage
- d ☐ Ineffective crank angle at TDC and BDC

11 Which of these statements, about an exhaust-driven turbocharger, is true?

- a ☐ It is more effective than an engine-driven supercharger at increasing the power output
- b ☐ It operates best at low engine speeds
- c ☐ It operates best at high engine speeds
- d ☐ It operates as soon as the throttle is opened

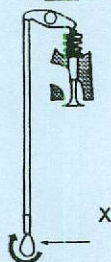


12 When the airflow over the propeller blades of a failed engine keeps the propeller turning, this is known as:

- a ☐ Propeller braking
- b ☐ Windmilling
- c ☐ Reverse thrust
- d ☐ Contra rotating

13 In this diagram of a piston engine's valve mechanism, the arrow X points to:

- a ☐ A pushrod
- b ☐ A cam
- c ☐ A tappet
- d ☐ A scraper



14 In a piston engine, ineffective crank angle occurs in the region of:

- a ☐ BDC only
- b ☐ 90 degrees after BDC and TDC
- c ☐ Both BDC and TDC
- d ☐ TDC only

15 Direct fuel injection is often used in aero piston engines, in preference to float chamber carburettors. Which of these statements applies to the direct fuel injection system?

- a ☐ There is no choke on the intake
- b ☐ The fuel does not have to be vaporised
- c ☐ A throttle butterfly is unnecessary
- d ☐ It cannot operate inverted

16 What is the primary function of a supercharger on a piston engine?

- a ☐ To ensure the battery is charged throughout the full range of engine speeds
- b ☐ To increase the pressure in the induction manifold
- c ☐ To speed up the extraction of exhaust gases
- d ☐ To make use of unburnt fuel in the exhaust gases

17 Propeller braking involves:

- a ☐ Turning the blades beyond fine pitch
- b ☐ Feathering the propeller
- c ☐ The selection of coarse pitch
- d ☐ The selection of fine pitch

18 In the turbofan engine, some of the air is not compressed fully. This air is made to bypass the combustion chamber and the overall jet velocity is thereby reduced. An important consequence is that:

- a ☐ The residual thrust is higher
- b ☐ The propulsive efficiency at lower aircraft speeds is improved
- c ☐ All the residual thrust is removed
- d ☐ The propulsive efficiency at higher aircraft speed is improved

19 After-burning in a jet engine involves burning additional fuel in the:

- a ☐ Combustion chamber
- b ☐ Turbine
- c ☐ Compressor
- d ☐ Jet pipe

20 In the modified 4-stroke cycle, ignition takes place:

- a ☐ Just before TDC on the compression stroke
- b ☐ Just before TDC on the power stroke
- c ☐ At TDC on the power stroke
- d ☐ At TDC on the compression stroke

21 What is the main function of a supercharger when fitted to a piston engine?

- a ☐ It delivers a stronger spark to the sparking plugs
- b ☐ It increases the amount of air and fuel delivered to the cylinders
- c ☐ It increases the amount of lubricating oil delivered to the bearings
- d ☐ It ensures that the batteries are always fully charged

22 In a simple 4-stroke piston engine, which of these air-to-fuel ratios (by weight) would be the normal mixture?

- a ☐ 15:01
- b ☐ 12:01
- c ☐ 06:01
- d ☐ 09:01

23 In a piston engine, far more oil is circulated than is needed to reduce friction alone. Why?

- a ☐ To cool the engine internally
- b ☐ To lubricate the pressure pump
- c ☐ To produce a full splash effect
- d ☐ To ensure the scavenge pump is always fed

24 In an aircraft propeller system the function of the constant speed unit (CSU) is to:

- a ☐ Increase the mixture strength
- b ☐ Feather the propeller
- c ☐ Maintain a selected engine speed within the power available
- d ☐ Retard the ignition timing

25 Which of these statements about the ramjet engine is true?

- a ☐ It is used only in sub-sonic aircraft
- b ☐ It requires an extra compressor to achieve the high ram pressure needed
- c ☐ It is like a turbojet from which the compressor and turbine have been removed
- d ☐ It is very susceptible to compressor stall