

AIRFRAME & POWERPLANT MECHANICS

POWERPLANT TEST GUIDE

Written, Oral & Practical FAA Exam Prep with Practical Test Standards

FOR USE WITH

FAA-H-8083-32A & FAA-H-8083-32A-ATB

Airframe & Powerplant Mechanics Handbook

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QUESTIONS

1-54 AMP068

The energy to turn the propeller on a turboprop engine is typically produced by

- A. additional compressor stages.
- B. additional turbine stages.
- C. use of a flow-through combustion chamber.

1-57 AMP068

Within the Brayton cycle of a turbine engine, in which section does air pressure remain constant and air volume greatly increase?

- A. Exhaust duct.
- B. Combustion chamber.
- C. Turbine assembly.

1-55 AMP068

A turboshaft engine can be defined as

- A. a gas turbine engine that delivers power through a shaft to operate something other than a propeller.
- B. a free turbine engine.
- C. a full bypass turbofan engine.

1-58 AMP068

What is described by the formula:

$FORCE = (MASS \times ACCELERATION) \div GRAVITY?$

- A. The Brayton Cycle
- B. Horsepower
- C. Thrust

1-56 AMP068

What is meant by a free turbine as it relates to turboprop and turboshaft engines?

- A. The compressor wheel is free turning and unconnected from the rest of the engine.
- B. The turbine wheel is not physically connected to the reduction gears and shaft.
- C. The turbine wheel is not physically connected to the compressor wheel.

1-59 AMP068

The most important factors affecting thermal efficiency in a turbine engine are

- A. compressor speed and exhaust gas temperature.
- B. total air temperature and compressor speed.
- C. turbine inlet temperature, compression ratio, and the component efficiencies of the compressor and turbine.

AIRCRAFT ENGINES

ANSWERS

1-54 Answer B.

Turboprops are, fundamentally, gas turbine engines that have a compressor, combustion section, turbine, and exhaust nozzle (gas generator), all of which operate in the same manner as any other gas engine turbine engine. However, the difference is that the turbine in the turboprop engine usually has extra stages to extract energy to drive the propeller.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 54]

1-55 Answer A.

A gas turbine engine that delivers power through a shaft to operate something other than a propeller is referred to as a turboshaft engine. The output shaft may be coupled directly to the engine turbine, or the shaft may be driven by a turbine of its own (free turbine). The turboshaft engine's output is measured in horsepower instead of thrust because the power output is turning a shaft.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 55]

1-56 Answer C.

A fixed turbine has a mechanical connection between each engine component and the reduction gear box. The free turbine has only an air link between the compressor/ combustion chamber and the turbine wheel. The turbine wheel is powered only by air pressure as the fast moving air enters its inlet nozzle.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 56]

1-57 Answer B.

During intake, air enters at ambient pressure and leaves with increased pressure and decreased volume. In the compressor, pressure is increased and volume is decreased. In the combustion chamber, pressure remains constant with a large increase in volume. In the turbine assembly the expanding gasses are converted from velocity to mechanical energy. In the convergent exhaust duct volume expands and pressure decreases yielding the final high velocity.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 60]

1-58 Answer C.

The formula shown $F = MA/G$ defines thrust. Horsepower is defined as ft-lb of force per second/550. The Brayton Cycle refers to the continuous combustion as an operating principle of turbine engines and does not have a formula.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 59]

1-59 Answer C.

Thermal efficiency is a prime factor in gas turbine performance; it's the ratio of net work produced by the engine to the chemical energy supplied in the form of fuel. The three most important factors affecting the thermal efficiency are turbine inlet temperature, compression ratio, and the component efficiencies of the compressor and turbine. Other factors that affect thermal efficiency are compressor inlet temperature and combustion efficiency.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 59]

QUESTIONS

1-60 AMP068

An engine's thrust output temporarily decreases as aircraft speed increases from static. This is overcome at higher speeds by

- A. turbine efficiency.
- B. ram air effect.
- C. exhaust nozzle pressure.

1-61 AMP061

Which of the following acts as a diffuser in a turbine engine and converts velocity to pressure?

- A. Impeller
- B. Manifold
- C. Stators

AIRCRAFT ENGINES

ANSWERS

1-60 Answer B.

A rise in pressure above ambient pressure at the engine inlet as a result of forward velocity of an aircraft is referred to as ram pressure. Since any ram effect causes an increase in compressor entrance pressure over atmospheric, the resulting pressure rise causes an increase in the mass airflow and gas velocity, both of which tend to increase thrust.

An engine's thrust output temporarily decreases as aircraft speed increases from static, but soon ceases to decrease. Moving toward higher speeds, thrust output increases again due to the increases pressure of ram recovery.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 60]

1-61 Answer C.

With an axial flow type compressor, the stator blades act as diffusers at each stage, partially converting high velocity air flow to pressure. Each consecutive pair of rotor and stator blades constitutes a pressure stage. Compressor pressure increases with the number of stages. Most engines utilize up to 16 such stages.

[Ref: Powerplant Handbook H-8083-32-ATB, Chapter 01 Page 41]

ORAL EXAM

Applicants for Powerplant Certification are required to answer oral examination questions before, after, or in conjunction with the practical examination portion of the airman certification process. The oral examination is used to establish knowledge. The practical examination is used to establish skill, which is the application of knowledge. Use the following questions to prepare for the oral examination. The questions are examples aligned with Practical Test Standards subject matter from which the examiner will choose topics for oral examination.

- 1-1(O). What is the reciprocating engine theory of operation?
- 1-2(O). What is the basic radial engine design and how does it operate?
- 1-3(O). What is firing order and how is it determined?
- 1-4(O). Why are valves adjusted on a radial engine?
- 1-5(O). What is the purpose of a master rod and articulating rods?
- 1-6(O). What is the purpose, function, and operation of multiple springs on a valve?
- 1-7(O). What is propeller reduction gearing and why is it used?
- 1-8(O). What is the basic theory of operation of a gas turbine engine?
- 1-9(O). What are some causes for turbine engine performance losses?
- 1-10(O). What is the purpose of a turbine engine diffuser?
- 1-11(O). What type of engine is a typical Auxiliary Power Unit (APU)? What is its function and how does it operate?