

✈ ETIHAD AIRWAYS PILOT APTITUDE TEST

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PHYSICS & SCIENCE — PRACTICE PAPER

COMPASS System | 50 Questions | Time Allowed: 40 Minutes | No Calculator Permitted

INSTRUCTIONS

- 1. This paper contains 50 questions across 10 physics and science topics tested in the Etihad Airways COMPASS pilot aptitude assessment.
- 2. Select the one best answer from the four options (A, B, C, D) for each question.
- 3. No calculator is permitted. All calculations must be performed mentally or on rough paper.
- 4. Time allowed is 40 minutes. Aim to spend no more than 48 seconds per question.

SECTION 1: Mechanics & Newton's Laws

Q1. During a runway operations briefing, During a runway operations briefing, Which of Newton's laws explains why a passenger moves forward when an aircraft stops suddenly?

- A) Law of Gravitation
- B) Second Law
- C) Third Law
- D) First Law

Q2. During a runway operations briefing, During a runway operations briefing, An aircraft of mass 55,000 kg accelerates at 3.5 m/s^2 . What is its net force?

- A) 80,000 N
- B) 192,500 N
- C) 120,000 N
- D) 200,000 N

Q3. During a runway operations briefing, During a runway operations briefing, A 9 kg load experiences a net force of 45 N. Find its acceleration.

- A) 5.0 m/s^2
- B) 2.0 m/s^2
- C) 5.0 m/s^2
- D) 8.0 m/s^2

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Q4. During a runway operations briefing, During a runway operations briefing, Which force acts opposite to the relative motion between an aircraft tyre and the runway?

- A) Friction
- B) Buoyancy
- C) Lift
- D) Thrust

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Q5. During a runway operations briefing, During a runway operations briefing, An object moves at constant velocity. Its resultant force is:

- A) Equal to its mass
- B) Increasing
- C) Maximum
- D) Zero

SECTION 2: Work, Energy & Power

Q6. During a runway operations briefing, During a runway operations briefing, A force of 450 N moves a crate 11 m in its direction. Work done?

- A) 2,400 J
- B) 4,950 J
- C) 1,200 J
- D) 4,800 J

Q7. During a runway operations briefing, During a runway operations briefing, What energy does an aircraft possess because of its height above the runway?

- A) Electrical energy
- B) Kinetic energy
- C) Sound energy
- D) Gravitational potential energy

Q8. During a runway operations briefing, During a runway operations briefing, A 5 kg object moves at 8 m/s. Its kinetic energy is:

- A) 100 J
- B) 160.0 J
- C) 25 J
- D) 50 J

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Q9. During a runway operations briefing, During a runway operations briefing, An engine performs 26,000 J of work in 13 s. Its average power is:

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- A) 4,000 W
- B) 1,000 W
- C) 2,000 W
- D) 2000 W

Q10. During a runway operations briefing, During a runway operations briefing, If an aircraft's speed triples, its kinetic energy becomes:

- A) Nine times greater
- B) Unchanged
- C) Three times greater
- D) One-third as large

SECTION 3: Fluid Dynamics & Aerodynamics

Q11. During a runway operations briefing, During a runway operations briefing, According to Bernoulli's principle, when airflow speed over a wing increases, pressure generally:

- A) Becomes zero
- B) Increases
- C) Decreases
- D) Remains identical

Q12. During a runway operations briefing, During a runway operations briefing, Air flowing through a narrower part of a tube has a speed that is generally:

- A) Zero
- B) Unrelated to area
- C) Lower
- D) Higher

Q13. During a runway operations briefing, During a runway operations briefing, The cross-sectional shape designed to generate lift is called a(n):

- A) Aileron
- B) Fuselage
- C) Airfoil
- D) Empennage

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Q14. During a runway operations briefing, During a runway operations briefing, Induced drag is most significant when an aircraft is flying at:

- A) Low speed and high lift
- B) High speed and low lift
- C) Zero angle of attack
- D) Taxiing with no lift

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Q15. During a runway operations briefing, During a runway operations briefing, Archimedes' principle is used to explain:

- A) Buoyant force
- B) Thermal expansion
- C) Magnetic flux
- D) Electrical resistance

SECTION 4: Gas Laws & Thermodynamics

Q16. During a runway operations briefing, During a runway operations briefing, Boyle's law relates pressure and volume when temperature is:

- A) Zero
- B) Constant
- C) Increasing
- D) Unknown

Q17. During a runway operations briefing, During a runway operations briefing, At constant pressure, the volume of a gas is proportional to its:

- A) Mass only
- B) Colour
- C) Absolute temperature
- D) Altitude only

Q18. During a runway operations briefing, During a runway operations briefing, An ideal gas at 330 K is heated to 660 K at constant pressure. Its volume will:

- A) Halve
- B) Stay fixed
- C) Become zero
- D) Double

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Q19. During a runway operations briefing, During a runway operations briefing, Heat transfer through direct contact in a solid is called:

- A) Evaporation
- B) Convection
- C) Radiation
- D) Conduction

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Q20. During a runway operations briefing, During a runway operations briefing, Absolute zero is approximately:

- A) $-273.15\text{ }^{\circ}\text{C}$
- B) $0\text{ }^{\circ}\text{C}$
- C) $-100\text{ }^{\circ}\text{C}$
- D) $273.15\text{ }^{\circ}\text{C}$

SECTION 5: Electricity & Magnetism

Q21. During a runway operations briefing, During a runway operations briefing, A 18 V battery is connected to a $6\text{ }\Omega$ resistor. Current?

- A) 3.00 A
- B) 1.00 A
- C) 6.00 A
- D) 3.00 A

Q22. During a runway operations briefing, During a runway operations briefing, Two resistors of $7\text{ }\Omega$ and $9\text{ }\Omega$ are connected in series. Total resistance?

- A) $16\text{ }\Omega$
- B) $24\text{ }\Omega$
- C) $2\text{ }\Omega$
- D) $4\text{ }\Omega$

Q23. During a runway operations briefing, During a runway operations briefing, The SI unit of electric charge is:

- A) Ohm
- B) Ampere
- C) Volt
- D) Coulomb

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Q24. During a runway operations briefing, During a runway operations briefing, A device that converts mechanical energy into electrical energy is a:

- A) Generator
- B) Battery
- C) Transformer
- D) Motor

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Q25. During a runway operations briefing, During a runway operations briefing, In a parallel circuit, if one branch opens, the other branches generally:

- A) Continue to operate
- B) Have zero voltage
- C) All stop
- D) Become insulators

SECTION 6: Waves, Sound & Optics

Q26. During a runway operations briefing, During a runway operations briefing, The unit of frequency is:

- A) Metre
- B) Hertz
- C) Joule
- D) Newton

Q27. During a runway operations briefing, During a runway operations briefing, An echo is produced mainly by:

- A) Reflection of sound
- B) Diffraction of heat
- C) Refraction of light
- D) Absorption of sound

Q28. During a runway operations briefing, During a runway operations briefing, Which electromagnetic wave has the longest wavelength?

- A) Radio wave
- B) Gamma ray
- C) Ultraviolet
- D) X-ray

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Q29. During a runway operations briefing, During a runway operations briefing, Light changes direction when entering a different medium. This is:

- A) Polarisation
- B) Resonance
- C) Reflection
- D) Refraction

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Q30. During a runway operations briefing, During a runway operations briefing, The speed of light in vacuum is approximately:

- A) 9.80 m/s^2
- B) $3.00 \times 10^8 \text{ m/s}$
- C) $3.40 \times 10^2 \text{ m/s}$
- D) $3.00 \times 10^5 \text{ m/s}$

SECTION 7: Mechanics & Circular Motion

Q31. During a runway operations briefing, During a runway operations briefing, The force directed toward the centre of circular motion is:

- A) Friction only
- B) Weight only
- C) Centripetal force
- D) Centrifugal force

Q32. During a runway operations briefing, During a runway operations briefing, A 8 kg object moving at 7 m/s has momentum:

- A) $56 \text{ kg}\cdot\text{m/s}$
- B) $20 \text{ kg}\cdot\text{m/s}$
- C) $9 \text{ kg}\cdot\text{m/s}$
- D) $40 \text{ kg}\cdot\text{m/s}$

Q33. During a runway operations briefing, During a runway operations briefing, An impulse equals force multiplied by:

- A) Distance
- B) Time interval
- C) Temperature
- D) Mass

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Q34. During a runway operations briefing, During a runway operations briefing, For a given mass, doubling angular speed makes rotational kinetic energy:

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- A) Half as large
- B) Unchanged
- C) Twice greater
- D) Four times greater

Q35. During a runway operations briefing, During a runway operations briefing, Torque is calculated as force multiplied by perpendicular:

- A) Mass
- B) Density
- C) Temperature
- D) Distance from the pivot

SECTION 8: Properties of Matter

Q36. During a runway operations briefing, During a runway operations briefing, Density is defined as:

- A) Volume ÷ mass
- B) Mass ÷ volume
- C) Force ÷ area
- D) Mass × volume

Q37. During a runway operations briefing, During a runway operations briefing, Hooke's law applies within the elastic limit and relates force to:

- A) Frequency only
- B) Extension
- C) Temperature only
- D) Pressure only

Q38. During a runway operations briefing, During a runway operations briefing, Pressure in a fluid is transmitted equally in all directions according to:

- A) Doppler effect
- B) Ohm's law
- C) Newton's first law
- D) Pascal's principle

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Q39. During a runway operations briefing, During a runway operations briefing, A liquid changing into a gas at its surface is called:

- A) Freezing
- B) Evaporation
- C) Sublimation
- D) Condensation

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Q40. During a runway operations briefing, During a runway operations briefing, A material with a fixed volume but no fixed shape is a:

- A) Gas only
- B) Solid
- C) Liquid
- D) Plasma only

SECTION 9: Aviation Science Applications

Q41. During a runway operations briefing, During a runway operations briefing, At high altitude, air density is generally:

- A) Infinite
- B) Unchanged everywhere
- C) Higher
- D) Lower

Q42. During a runway operations briefing, During a runway operations briefing, A pitot-static system is used to sense:

- A) Battery charge
- B) Oil colour
- C) Fuel temperature
- D) Static and dynamic pressure

Q43. During a runway operations briefing, During a runway operations briefing, The primary effect of extending flaps during approach is to increase:

- A) Lift and drag
- B) Only altitude
- C) Only engine thrust
- D) Electrical resistance

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Q44. During a runway operations briefing, During a runway operations briefing, Mach number is the ratio of aircraft speed to the local speed of:

- A) Light
- B) Wind direction
- C) Sound
- D) Stall speed

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Q45. During a runway operations briefing, During a runway operations briefing, A stall occurs when the wing exceeds its critical:

- A) Engine temperature
- B) Aspect ratio
- C) Angle of attack
- D) Fuel pressure

SECTION 10: General Science & Calculations

Q46. During a runway operations briefing, During a runway operations briefing, A 24 V circuit carries 3.5 A. Electrical power?

- A) 84.0 W
- B) 10 W
- C) 60 W
- D) 20 W

Q47. During a runway operations briefing, During a runway operations briefing, A lever lifts 550 N using an effort of 130 N. Mechanical advantage?

- A) 3.00
- B) 5.00
- C) 4.23
- D) 2.00

Q48. During a runway operations briefing, During a runway operations briefing, An object falls from rest for 3.5 s. Using $g = 9.8 \text{ m/s}^2$, final speed is approximately:

- A) 9.8 m/s
- B) 34.3 m/s
- C) 19.6 m/s
- D) 29.4 m/s

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Q49. During a runway operations briefing, During a runway operations briefing, A force of 110 N acts over an area of 7 m². Pressure?

- A) 15.7 Pa
- B) 20 Pa
- C) 40 Pa
- D) 100 Pa

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Q50. During a runway operations briefing, During a runway operations briefing, A hydraulic piston has area ratio 4:10. An input of 35 N produces an output force of:

- A) 87.5 N
- B) 100 N
- C) 20 N
- D) 300 N

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ANSWER KEY & EXPLANATIONS

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Q1. Correct Answer: D) First Law

Explanation: Inertia resists a change in motion.

Q2. Correct Answer: B) 192,500 N

Explanation: Use $F = ma$.

Q3. Correct Answer: A) 5.0 m/s²

Explanation: Use $a = F \div m$.

Q4. Correct Answer: A) Friction

Explanation: Friction opposes relative motion.

Q5. Correct Answer: D) Zero

Explanation: Constant velocity means zero acceleration.

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Q6. What type of energy does an aircraft possess due to its altitude?

ANSWER KEY & EXPLANATIONS

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Q6. Correct Answer: B) 4,950 J

Explanation: Use $W = Fd$.

Q7. Correct Answer: D) Gravitational potential energy

Explanation: Height gives gravitational potential energy.

Q8. Correct Answer: B) 160.0 J

Explanation: Use $KE = \frac{1}{2}mv^2$.

Q9. Correct Answer: D) 2000 W

Explanation: Use $P = W \div t$.

Q10. Correct Answer: A) Nine times greater

Explanation: Kinetic energy is proportional to v^2 .

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ANSWER KEY & EXPLANATIONS

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Q11. Correct Answer: C) Decreases

Explanation: Higher speed is associated with lower static pressure.

Q12. Correct Answer: D) Higher

Explanation: Continuity gives $A_1V_1 = A_2V_2$.

Q13. Correct Answer: C) Airfoil

Explanation: An airfoil produces a pressure difference.

Q14. Correct Answer: A) Low speed and high lift

Explanation: Induced drag is linked to lift generation.

Q15. Correct Answer: A) Buoyant force

Explanation: Buoyancy equals the weight of displaced fluid.

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Explanation: Gay Lussac's Law states that the pressure of a fixed mass of gas is directly proportional to its absolute temperature, provided the volume remains constant.

ANSWER KEY & EXPLANATIONS

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Q16. Correct Answer: B) Constant

Explanation: For fixed mass and temperature, PV is constant.

Q17. Correct Answer: C) Absolute temperature

Explanation: This is Charles's law.

Q18. Correct Answer: D) Double

Explanation: Volume is proportional to absolute temperature.

Q19. Correct Answer: D) Conduction

Explanation: Conduction transfers energy through contact.

Q20. Correct Answer: A) $-273.15\text{ }^{\circ}\text{C}$

Explanation: 0 K corresponds to $-273.15\text{ }^{\circ}\text{C}$.

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✓ Correct Answer: B) Constant

ANSWER KEY & EXPLANATIONS

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Q21. Correct Answer: A) 3.00 A

Explanation: Use $I = V \div R$.

Q22. Correct Answer: A) 16 Ω

Explanation: Series resistances add.

Q23. Correct Answer: D) Coulomb

Explanation: Charge is measured in coulombs.

Q24. Correct Answer: A) Generator

Explanation: A generator produces electrical output from motion.

Q25. Correct Answer: A) Continue to operate

Explanation: Parallel branches provide separate paths.

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ANSWER KEY & EXPLANATIONS

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Q26. Correct Answer: B) Hertz

Explanation: One hertz is one cycle per second.

Q27. Correct Answer: A) Reflection of sound

Explanation: Sound reflects from a surface.

Q28. Correct Answer: A) Radio wave

Explanation: Radio waves have the lowest frequency in this list.

Q29. Correct Answer: D) Refraction

Explanation: Refraction is a change in direction due to speed change.

Q30. Correct Answer: B) 3.00×10^8 m/s

Explanation: This is the accepted approximate value.

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Rotational equivalent of linear force.

ANSWER KEY & EXPLANATIONS

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Q31. Correct Answer: C) Centripetal force

Explanation: Centripetal means centre-seeking.

Q32. Correct Answer: A) 56 kg·m/s

Explanation: Momentum $p = mv$.

Q33. Correct Answer: B) Time interval

Explanation: Impulse $J = F\Delta t$.

Q34. Correct Answer: D) Four times greater

Explanation: Rotational kinetic energy is proportional to ω^2 .

Q35. Correct Answer: D) Distance from the pivot

Explanation: $\tau = Fd_{\perp}$.

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✓ Correct Answer: B) Equilibrium

ANSWER KEY & EXPLANATIONS

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Q36. Correct Answer: B) Mass ÷ volume

Explanation: $\rho = m/V$.

Q37. Correct Answer: B) Extension

Explanation: $F = kx$ within the elastic region.

Q38. Correct Answer: D) Pascal's principle

Explanation: This is Pascal's law.

Q39. Correct Answer: B) Evaporation

Explanation: Evaporation occurs at the surface.

Q40. Correct Answer: C) Liquid

Explanation: A liquid takes the shape of its container.

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ANSWER KEY & EXPLANATIONS

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Q41. Correct Answer: D) Lower

Explanation: Air becomes less dense with altitude.

Q42. Correct Answer: D) Static and dynamic pressure

Explanation: The system supports airspeed measurement.

Q43. Correct Answer: A) Lift and drag

Explanation: Flaps allow slower flight but add drag.

Q44. Correct Answer: C) Sound

Explanation: $Mach = v / \text{speed of sound}$.

Q45. Correct Answer: C) Angle of attack

Explanation: Exceeding critical AoA causes lift loss.

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