

✈ 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 night-flight systems check, Which of Newton's laws explains why a passenger moves forward when an aircraft stops suddenly?

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

Q2. During a night-flight systems check, An aircraft of mass 65,000 kg accelerates at 4.5 m/s^2 . What is its net force?

- A) 200,000 N
- B) 80,000 N
- C) 292,500 N
- D) 120,000 N

Q3. During a night-flight systems check, A 11 kg load experiences a net force of 55 N. Find its acceleration.

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

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Q4. During a night-flight systems check, During a night-flight systems check, Which force acts opposite to the relative motion between an aircraft tyre and the runway?

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

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Q5. During a night-flight systems check, During a night-flight systems check, An object moves at constant velocity. Its resultant force is:

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

SECTION 2: Work, Energy & Power

Q6. During a night-flight systems check, During a night-flight systems check, A force of 550 N moves a crate 13 m in its direction. Work done?

- A) 2,400 J
- B) 7,150 J
- C) 1,200 J
- D) 4,800 J

Q7. During a night-flight systems check, During a night-flight systems check, What energy does an aircraft possess because of its height above the runway?

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

Q8. During a night-flight systems check, During a night-flight systems check, A 7 kg object moves at 10 m/s. Its kinetic energy is:

- A) 50 J
- B) 100 J
- C) 25 J
- D) 350.0 J

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Q9. During a night-flight systems check, During a night-flight systems check, An engine performs 30,000 J of work in 15 s. Its average power is:

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

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Q10. During a night-flight systems check, During a night-flight systems check, If an aircraft's speed triples, its kinetic energy becomes:

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

SECTION 3: Fluid Dynamics & Aerodynamics

Q11. During a night-flight systems check, During a night-flight systems check, According to Bernoulli's principle, when airflow speed over a wing increases, pressure generally:

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

Q12. During a night-flight systems check, During a night-flight systems check, Air flowing through a narrower part of a tube has a speed that is generally:

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

Q13. During a night-flight systems check, During a night-flight systems check, The cross-sectional shape designed to generate lift is called a(n):

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

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Q14. During a night-flight systems check, During a night-flight systems check, Induced drag is most significant when an aircraft is flying at:

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

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Q15. During a night-flight systems check, During a night-flight systems check, Archimedes' principle is used to explain:

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

SECTION 4: Gas Laws & Thermodynamics

Q16. During a night-flight systems check, During a night-flight systems check, Boyle's law relates pressure and volume when temperature is:

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

Q17. During a night-flight systems check, During a night-flight systems check, At constant pressure, the volume of a gas is proportional to its:

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

Q18. During a night-flight systems check, During a night-flight systems check, An ideal gas at 350 K is heated to 700 K at constant pressure. Its volume will:

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

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Q19. During a night-flight systems check, During a night-flight systems check, Heat transfer through direct contact in a solid is called:

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

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Q20. During a night-flight systems check, During a night-flight systems check, Absolute zero is approximately:

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

SECTION 5: Electricity & Magnetism

Q21. During a night-flight systems check, During a night-flight systems check, A 22 V battery is connected to a $8\text{ }\Omega$ resistor. Current?

- A) 1.00 A
- B) 6.00 A
- C) 3.00 A
- D) 2.75 A

Q22. During a night-flight systems check, During a night-flight systems check, Two resistors of $9\text{ }\Omega$ and $11\text{ }\Omega$ are connected in series. Total resistance?

- A) $2\text{ }\Omega$
- B) $20\text{ }\Omega$
- C) $4\text{ }\Omega$
- D) $24\text{ }\Omega$

Q23. During a night-flight systems check, During a night-flight systems check, The SI unit of electric charge is:

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

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Q24. During a night-flight systems check, During a night-flight systems check, A device that converts mechanical energy into electrical energy is a:

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

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Q25. During a night-flight systems check, During a night-flight systems check, 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 night-flight systems check, During a night-flight systems check, The unit of frequency is:

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

Q27. During a night-flight systems check, During a night-flight systems check, An echo is produced mainly by:

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

Q28. During a night-flight systems check, During a night-flight systems check, Which electromagnetic wave has the longest wavelength?

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

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Q29. During a night-flight systems check, During a night-flight systems check, Light changes direction when entering a different medium. This is:

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

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Q30. During a night-flight systems check, During a night-flight systems check, The speed of light in vacuum is approximately:

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

SECTION 7: Mechanics & Circular Motion

Q31. During a night-flight systems check, During a night-flight systems check, The force directed toward the centre of circular motion is:

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

Q32. During a night-flight systems check, During a night-flight systems check, A 10 kg object moving at 9 m/s has momentum:

- A) $40 \text{ kg}\cdot\text{m/s}$
- B) $9 \text{ kg}\cdot\text{m/s}$
- C) $20 \text{ kg}\cdot\text{m/s}$
- D) $90 \text{ kg}\cdot\text{m/s}$

Q33. During a night-flight systems check, During a night-flight systems check, An impulse equals force multiplied by:

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

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Q34. During a night-flight systems check, During a night-flight systems check, For a given mass, doubling angular speed makes rotational kinetic energy:

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

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Q35. During a night-flight systems check, During a night-flight systems check, Torque is calculated as force multiplied by perpendicular:

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

SECTION 8: Properties of Matter

Q36. During a night-flight systems check, During a night-flight systems check, Density is defined as:

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

Q37. During a night-flight systems check, During a night-flight systems check, Hooke's law applies within the elastic limit and relates force to:

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

Q38. During a night-flight systems check, During a night-flight systems check, Pressure in a fluid is transmitted equally in all directions according to:

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

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Q39. During a night-flight systems check, During a night-flight systems check, A liquid changing into a gas at its surface is called:

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

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Q40. During a night-flight systems check, During a night-flight systems check, A material with a fixed volume but no fixed shape is a:

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

SECTION 9: Aviation Science Applications

Q41. During a night-flight systems check, During a night-flight systems check, At high altitude, air density is generally:

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

Q42. During a night-flight systems check, During a night-flight systems check, A pitot-static system is used to sense:

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

Q43. During a night-flight systems check, During a night-flight systems check, The primary effect of extending flaps during approach is to increase:

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

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Q44. During a night-flight systems check, During a night-flight systems check, Mach number is the ratio of aircraft speed to the local speed of:

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

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Q45. During a night-flight systems check, During a night-flight systems check, A stall occurs when the wing exceeds its critical:

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

SECTION 10: General Science & Calculations

Q46. During a night-flight systems check, During a night-flight systems check, A 30 V circuit carries 4.5 A. Electrical power?

- A) 60 W
- B) 135.0 W
- C) 10 W
- D) 20 W

Q47. During a night-flight systems check, During a night-flight systems check, A lever lifts 650 N using an effort of 150 N. Mechanical advantage?

- A) 2.00
- B) 4.33
- C) 3.00
- D) 5.00

Q48. During a night-flight systems check, During a night-flight systems check, An object falls from rest for 4.5 s. Using $g = 9.8 \text{ m/s}^2$, final speed is approximately:

- A) 44.1 m/s
- B) 19.6 m/s
- C) 9.8 m/s
- D) 29.4 m/s

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Q49. During a night-flight systems check, During a night-flight systems check, A force of 130 N acts over an area of 9 m². Pressure?

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- A) 40 Pa
- B) 14.4 Pa
- C) 20 Pa
- D) 100 Pa

Q50. During a night-flight systems check, During a night-flight systems check, A hydraulic piston has area ratio 6:10. An input of 45 N produces an output force of:

- A) 100 N
- B) 20 N
- C) 75.0 N
- D) 300 N

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ANSWER KEY & EXPLANATIONS

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Q1. Correct Answer: B) First Law

Explanation: Inertia resists a change in motion.

Q2. Correct Answer: C) 292,500 N

Explanation: Use $F = ma$.

Q3. Correct Answer: A) 5.0 m/s²

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

Q4. Correct Answer: C) 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) 7,150 J

Explanation: Use $W = Fd$.

Q7. Correct Answer: D) Gravitational potential energy

Explanation: Height gives gravitational potential energy.

Q8. Correct Answer: D) 350.0 J

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

Q9. Correct Answer: C) 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: A) 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: A) 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: D) Absolute temperature

Explanation: This is Charles's law.

Q18. Correct Answer: B) Double

Explanation: Volume is proportional to absolute temperature.

Q19. Correct Answer: C) Conduction

Explanation: Conduction transfers energy through contact.

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

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: D) 2.75 A

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

Q22. Correct Answer: B) 20 Ω

Explanation: Series resistances add.

Q23. Correct Answer: B) Coulomb

Explanation: Charge is measured in coulombs.

Q24. Correct Answer: C) 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: D) 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: C) 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: B) Centripetal force

Explanation: Centripetal means centre-seeking.

Q32. Correct Answer: D) 90 kg·m/s

Explanation: Momentum $p = mv$.

Q33. Correct Answer: C) Time interval

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

Q34. Correct Answer: B) 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) Equival

ANSWER KEY & EXPLANATIONS

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Q36. Correct Answer: D) Mass ÷ volume

Explanation: $\rho = m/V$.

Q37. Correct Answer: D) Extension

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

Q38. Correct Answer: C) Pascal's principle

Explanation: This is Pascal's law.

Q39. Correct Answer: B) Evaporation

Explanation: Evaporation occurs at the surface.

Q40. Correct Answer: A) Liquid

Explanation: A liquid takes the shape of its container.

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ANSWER KEY & EXPLANATIONS

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Q41. Correct Answer: C) 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: B) Angle of attack

Explanation: Exceeding critical AoA causes lift loss.

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