

✈ 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 coastal training flight, During a coastal training flight, Which of Newton's laws explains why a passenger moves forward when an aircraft stops suddenly?

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

Q2. During a coastal training flight, During a coastal training flight, An aircraft of mass 45,000 kg accelerates at 2.5 m/s^2 . What is its net force?

- A) 200,000 N
- B) 112,500 N
- C) 80,000 N
- D) 120,000 N

Q3. During a coastal training flight, During a coastal training flight, A 7 kg load experiences a net force of 35 N. Find its acceleration.

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

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

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

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Q5. During a coastal training flight, During a coastal training flight, An object moves at constant velocity. Its resultant force is:

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

SECTION 2: Work, Energy & Power

Q6. During a coastal training flight, During a coastal training flight, A force of 350 N moves a crate 9 m in its direction. Work done?

- A) 3,150 J
- B) 4,800 J
- C) 2,400 J
- D) 1,200 J

Q7. During a coastal training flight, During a coastal training flight, What energy does an aircraft possess because of its height above the runway?

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

Q8. During a coastal training flight, During a coastal training flight, A 3 kg object moves at 6 m/s. Its kinetic energy is:

- A) 25 J
- B) 50 J
- C) 54.0 J
- D) 100 J

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Q9. During a coastal training flight, During a coastal training flight, An engine performs 22,000 J of work in 11 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 coastal training flight, During a coastal training flight, 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 coastal training flight, During a coastal training flight, According to Bernoulli's principle, when airflow speed over a wing increases, pressure generally:

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

Q12. During a coastal training flight, During a coastal training flight, Air flowing through a narrower part of a tube has a speed that is generally:

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

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

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

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Q14. During a coastal training flight, During a coastal training flight, 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 coastal training flight, During a coastal training flight, Archimedes' principle is used to explain:

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

SECTION 4: Gas Laws & Thermodynamics

Q16. During a coastal training flight, During a coastal training flight, Boyle's law relates pressure and volume when temperature is:

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

Q17. During a coastal training flight, During a coastal training flight, At constant pressure, the volume of a gas is proportional to its:

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

Q18. During a coastal training flight, During a coastal training flight, An ideal gas at 310 K is heated to 620 K at constant pressure. Its volume will:

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

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Q19. During a coastal training flight, During a coastal training flight, Heat transfer through direct contact in a solid is called:

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

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Q20. During a coastal training flight, During a coastal training flight, Absolute zero is approximately:

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

SECTION 5: Electricity & Magnetism

Q21. During a coastal training flight, During a coastal training flight, A 14 V battery is connected to a $4\text{ }\Omega$ resistor. Current?

- A) 6.00 A
- B) 1.00 A
- C) 3.50 A
- D) 3.00 A

Q22. During a coastal training flight, During a coastal training flight, Two resistors of $5\text{ }\Omega$ and $7\text{ }\Omega$ are connected in series. Total resistance?

- A) $2\text{ }\Omega$
- B) $24\text{ }\Omega$
- C) $4\text{ }\Omega$
- D) $12\text{ }\Omega$

Q23. During a coastal training flight, During a coastal training flight, The SI unit of electric charge is:

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

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Q24. During a coastal training flight, During a coastal training flight, A device that converts mechanical energy into electrical energy is a:

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

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Q25. During a coastal training flight, During a coastal training flight, In a parallel circuit, if one branch opens, the other branches generally:

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

SECTION 6: Waves, Sound & Optics

Q26. During a coastal training flight, During a coastal training flight, The unit of frequency is:

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

Q27. During a coastal training flight, During a coastal training flight, An echo is produced mainly by:

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

Q28. During a coastal training flight, During a coastal training flight, Which electromagnetic wave has the longest wavelength?

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

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Q29. During a coastal training flight, During a coastal training flight, Light changes direction when entering a different medium. This is:

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

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Q30. During a coastal training flight, During a coastal training flight, The speed of light in vacuum is approximately:

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

SECTION 7: Mechanics & Circular Motion

Q31. During a coastal training flight, During a coastal training flight, The force directed toward the centre of circular motion is:

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

Q32. During a coastal training flight, During a coastal training flight, A 6 kg object moving at 5 m/s has momentum:

- A) $40 \text{ kg}\cdot\text{m/s}$
- B) $30 \text{ kg}\cdot\text{m/s}$
- C) $9 \text{ kg}\cdot\text{m/s}$
- D) $20 \text{ kg}\cdot\text{m/s}$

Q33. During a coastal training flight, During a coastal training flight, An impulse equals force multiplied by:

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

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Q34. During a coastal training flight, During a coastal training flight, For a given mass, doubling angular speed makes rotational kinetic energy:

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

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Q35. During a coastal training flight, During a coastal training flight, Torque is calculated as force multiplied by perpendicular:

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

SECTION 8: Properties of Matter

Q36. During a coastal training flight, During a coastal training flight, Density is defined as:

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

Q37. During a coastal training flight, During a coastal training flight, Hooke's law applies within the elastic limit and relates force to:

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

Q38. During a coastal training flight, During a coastal training flight, Pressure in a fluid is transmitted equally in all directions according to:

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

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Q39. During a coastal training flight, During a coastal training flight, A liquid changing into a gas at its surface is called:

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

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Q40. During a coastal training flight, During a coastal training flight, A material with a fixed volume but no fixed shape is a:

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

SECTION 9: Aviation Science Applications

Q41. During a coastal training flight, During a coastal training flight, At high altitude, air density is generally:

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

Q42. During a coastal training flight, During a coastal training flight, A pitot-static system is used to sense:

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

Q43. During a coastal training flight, During a coastal training flight, The primary effect of extending flaps during approach is to increase:

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

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Q44. During a coastal training flight, During a coastal training flight, Mach number is the ratio of aircraft speed to the local speed of:

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

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Q45. During a coastal training flight, During a coastal training flight, A stall occurs when the wing exceeds its critical:

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

SECTION 10: General Science & Calculations

Q46. During a coastal training flight, During a coastal training flight, A 18 V circuit carries 2.5 A. Electrical power?

- A) 45.0 W
- B) 60 W
- C) 10 W
- D) 20 W

Q47. During a coastal training flight, During a coastal training flight, A lever lifts 450 N using an effort of 110 N. Mechanical advantage?

- A) 3.00
- B) 4.09
- C) 5.00
- D) 2.00

Q48. During a coastal training flight, During a coastal training flight, An object falls from rest for 2.5 s. Using $g = 9.8 \text{ m/s}^2$, final speed is approximately:

- A) 19.6 m/s
- B) 24.5 m/s
- C) 9.8 m/s
- D) 29.4 m/s

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Q49. During a coastal training flight, During a coastal training flight, A force of 90 N acts over an area of 5 m². Pressure?

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- A) 18.0 Pa
- B) 40 Pa
- C) 100 Pa
- D) 20 Pa

Q50. During a coastal training flight, During a coastal training flight, A hydraulic piston has area ratio 2:10. An input of 25 N produces an output force of:

- A) 20 N
- B) 125.0 N
- C) 100 N
- D) 300 N

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ANSWER KEY & EXPLANATIONS

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Q1. Correct Answer: A) First Law

Explanation: Inertia resists a change in motion.

Q2. Correct Answer: B) 112,500 N

Explanation: Use $F = ma$.

Q3. Correct Answer: C) 5.0 m/s²

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

Q4. Correct Answer: C) Friction

Explanation: Friction opposes relative motion.

Q5. Correct Answer: B) 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: A) 3,150 J

Explanation: Use $W = Fd$.

Q7. Correct Answer: B) Gravitational potential energy

Explanation: Height gives gravitational potential energy.

Q8. Correct Answer: C) 54.0 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: B) Decreases

Explanation: Higher speed is associated with lower static pressure.

Q12. Correct Answer: C) 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: D) Constant

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

Q17. Correct Answer: B) Absolute temperature

Explanation: This is Charles's law.

Q18. Correct Answer: A) Double

Explanation: Volume is proportional to absolute temperature.

Q19. Correct Answer: A) 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: D) Constant

ANSWER KEY & EXPLANATIONS

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Q21. Correct Answer: C) 3.50 A

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

Q22. Correct Answer: D) 12 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: C) Hertz

Explanation: One hertz is one cycle per second.

Q27. Correct Answer: C) 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: B) 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: D) Centripetal force

Explanation: Centripetal means centre-seeking.

Q32. Correct Answer: B) 30 kg·m/s

Explanation: Momentum $p = mv$.

Q33. Correct Answer: B) Time interval

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

Q34. Correct Answer: A) Four times greater

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

Q35. Correct Answer: B) 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: C) Mass ÷ volume

Explanation: $\rho = m/V$.

Q37. Correct Answer: A) Extension

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

Q38. Correct Answer: C) Pascal's principle

Explanation: This is Pascal's law.

Q39. Correct Answer: D) 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: C) Lift and drag

Explanation: Flaps allow slower flight but add drag.

Q44. Correct Answer: B) Sound

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

Q45. Correct Answer: A) Angle of attack

Explanation: Exceeding critical AoA causes lift loss.

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