



EMIRATES AIRLINE PILOT APTITUDE TEST

PHYSICS & SCIENCE — PRACTICE PAPER (Model B)

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

INSTRUCTIONS

- This paper contains 50 questions across 10 physics and science topics tested in the Emirates Airline COMPASS pilot aptitude assessment.
- Select the one best answer from the four options (A, B, C, D) for each question.
- No calculator is permitted. All calculations must be performed mentally or on rough paper.
- Time allowed is 40 minutes. Aim to spend no more than 48 seconds per question.
- Attempt all questions. There is no negative marking.
- A full Answer Key with Explanations is provided at the end of this paper.

SECTION 1: Mechanics & Newton's Laws

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

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

Q2. During a runway operations briefing, An aircraft of mass 55,000 kg accelerates at 3.5 m/s². What is its net force?

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

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

- A) 2.0 m/s²
- B) 8.0 m/s²
- C) 5.0 m/s²
- D) 5.0 m/s²

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

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

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

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

SECTION 2: Work, Energy & Power

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

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

Q7. During a runway operations briefing, 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 runway operations briefing, A 5 kg object moves at 8 m/s. Its kinetic energy is:

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

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

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

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

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

SECTION 3: Fluid Dynamics & Aerodynamics

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

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

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Q12. During a runway operations briefing, 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 runway operations briefing, The cross-sectional shape designed to generate lift is called a(n):

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

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

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

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

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

SECTION 4: Gas Laws & Thermodynamics

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

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

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

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

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

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

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

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

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

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

SECTION 5: Electricity & Magnetism

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

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

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

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

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

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

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

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

Q25. 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

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SECTION 6: Waves, Sound & Optics

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

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

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

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

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

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

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

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

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

- A) 3.40×10^2 m/s
- B) 3.00×10^8 m/s
- C) 9.80 m/s²
- D) 3.00×10^5 m/s

SECTION 7: Mechanics & Circular Motion

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

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

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

- A) 20 kg·m/s
- B) 40 kg·m/s
- C) 56 kg·m/s
- D) 9 kg·m/s

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

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

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

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

Q35. During a runway operations briefing, 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 runway operations briefing, Density is defined as:

- A) Mass $\times$ volume
- B) Volume $\div$ mass
- C) Mass $\div$ volume
- D) Force $\div$ area

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

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

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

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

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

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

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

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

SECTION 9: Aviation Science Applications

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

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

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

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

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

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

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

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

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

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

SECTION 10: General Science & Calculations

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

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

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

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

Q48. 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) 29.4 m/s
- B) 34.3 m/s
- C) 9.8 m/s
- D) 19.6 m/s

Q49. During a runway operations briefing, A force of 110 N acts over an area of 7 m^2 . Pressure?

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

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

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

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ANSWER KEY & EXPLANATIONS

Q1. ✓ Correct Answer: B) 2nd

Explanation: Force equals mass times acceleration.

Q2. ✓ Correct Answer: B) 5

Explanation: $a = F/m = 50/10 = 5 \text{ m/s}^2$.

Q3. ✓ Correct Answer: C) 3rd

Explanation: Every action has an equal and opposite reaction.

Q4. ✓ Correct Answer: B) 50 N

Explanation: $W = m * g = 5 * 10 = 50 \text{ N}$.

Q5. ✓ Correct Answer: C) Both

Explanation: Vectors define magnitude and direction.

Q6. ✓ Correct Answer: B) Distance

Q1. Correct Answer: B) First Law

Explanation: Inertia resists a change in motion.

Q2. Correct Answer: A) 192,500 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: A) Zero

Explanation: Constant velocity means zero acceleration.

Q6. Correct Answer: D) 4,950 J

Explanation: Use $W = Fd$.

Q7. Correct Answer: D) Gravitational potential energy

Explanation: Height gives gravitational potential energy.

Q8. Correct Answer: A) 160.0 J

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

Q9. Correct Answer: B) 2000 W

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

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Explanation: Drag increases rapidly as speed increases.

Q10. Correct Answer: D) Nine times greater

Explanation: Kinetic energy is proportional to v^2 .

Q11. Correct Answer: A) Decreases

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Explanation: Higher speed is associated with lower static pressure.

Q12. Correct Answer: D) Higher

Q16. ✓ Correct Answer: B) Boyle

Explanation: Boyle's Law for isothermal processes.

Q17. ✓ Correct Answer: B) 15

Explanation: ISA standard temperature.

Q18. ✓ Correct Answer: B) Fluids (Liquids/Gases)

Explanation: Transfer by bulk movement of fluid.

Q19. ✓ Correct Answer: C) 273 K

Explanation: $0^{\circ}\text{C} + 273 = 273 \text{ K}$.

Q20. ✓ Correct Answer: B) Decreased

Explanation: Boyle's Law relationship.

Q21. ✓ Correct Answer: C) Ampere

Explanation: Flow of charge per second.

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

Explanation: Induced drag is linked to lift generation.

Q15. Correct Answer: C) Buoyant force

Explanation: Buoyancy equals the weight of displaced fluid.

Q16. Correct Answer: D) 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: D) Double

Explanation: Volume is proportional to absolute temperature.

Q19. Correct Answer: D) Conduction

Explanation: Conduction transfers energy through contact.

Q20. Correct Answer: D) -273.15°C

Explanation: 0 K corresponds to -273.15°C .

Q21. Correct Answer: A) 3.00 A

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

Q22. Correct Answer: D) 16 Ω

Explanation: Series resistances add.

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Q23. Correct Answer: D) Coulomb
Explanation: Charge is measured in coulombs.

Q24. Correct Answer: C) Generator

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Explanation: A generator produces electrical output from motion.

Q25. Correct Answer: B) Continue to operate

Q32. ✓ Correct Answer: C) Universe

Explanation: Universal Gravitational Constant.

Q33. ✓ Correct Answer: C) 20

Explanation: $5 * 4 = 20 \text{ kg}\cdot\text{m/s}$.

Q34. ✓ Correct Answer: B) Time

Explanation: Change in momentum.

Q35. ✓ Correct Answer: B) rad/s

Explanation: Standard SI unit.

Q36. ✓ Correct Answer: B) 1

Explanation: Water is the reference standard.

Q37. ✓ Correct Answer: B) Area

Explanation: $P = F / A$.

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: C) Refraction

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

Q30. Correct Answer: C) $3.00 \times 10^8 \text{ m/s}$

Explanation: This is the accepted approximate value.

Q31. Correct Answer: B) Centripetal force

Explanation: Centripetal means centre-seeking.

Q32. Correct Answer: A) $56 \text{ kg}\cdot\text{m/s}$

Explanation: Momentum $p = mv$.

Q33. Correct Answer: D) 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: C) Distance from the pivot

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

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Q36. Correct Answer: A) $156 \times 10^{-10} \text{ m}$

Explanation: $\rho = m/V$.

Q37. Correct Answer: C) Extension

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

Q38. Correct Answer: A) Pascal's principle

Q48. ✓ Correct Answer: A) 10

Explanation: $a = 20 / 2 = 10 \text{ m/s}^2$.

Q49. ✓ Correct Answer: A) 50

Explanation: $P = 100 / 2 = 50 \text{ W}$.

Q50. ✓ Correct Answer: B) 50

Explanation: $\rho = 100 / 2 = 50 \text{ kg/m}^3$.

Q39. Correct Answer: B) Evaporation

Explanation: Evaporation occurs at the surface.

Q40. Correct Answer: D) Liquid

Explanation: A liquid takes the shape of its container.

Q41. Correct Answer: C) Lower

Explanation: Air becomes less dense with altitude.

Q42. Correct Answer: C) 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: D) Sound

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

Q45. Correct Answer: D) Angle of attack

Explanation: Exceeding critical AoA causes lift loss.

Q46. Correct Answer: D) 84.0 W

Explanation: Use $P = VI$.

Q47. Correct Answer: D) 4.23

Explanation: $MA = \text{load} \div \text{effort}$.

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Q48. Correct Answer: D) 34.3 m/s

Explanation: Use $v = gt$.

Q49. Correct Answer: C) 15.7 Pa

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Explanation: Use $P = F/A$.

Q50. Correct Answer: C) 87.5 N