



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. In a mountain-airfield exercise, 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. In a mountain-airfield exercise, An aircraft of mass 70,000 kg accelerates at 5.0 m/s^2 . What is its net force?

- A) 80,000 N
- B) 200,000 N
- C) 120,000 N
- D) 350,000 N

Q3. In a mountain-airfield exercise, A 12 kg load experiences a net force of 60 N. Find its acceleration.

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

Q4. In a mountain-airfield exercise, Which force acts opposite to the relative motion between an aircraft tyre and the runway?

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

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Q5. In a mountain-airfield exercise, An object moves at constant velocity. Its resultant force is:

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

SECTION 2: Work, Energy & Power

Q6. In a mountain-airfield exercise, A force of 600 N moves a crate 14 m in its direction. Work done?

- A) 8,400 J
- B) 2,400 J
- C) 4,800 J
- D) 1,200 J

Q7. In a mountain-airfield exercise, What energy does an aircraft possess because of its height above the runway?

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

Q8. In a mountain-airfield exercise, A 8 kg object moves at 11 m/s. Its kinetic energy is:

- A) 100 J
- B) 50 J
- C) 484.0 J
- D) 25 J

Q9. In a mountain-airfield exercise, An engine performs 32,000 J of work in 16 s. Its average power is:

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

Q10. In a mountain-airfield exercise, If an aircraft's speed triples, its kinetic energy becomes:

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

SECTION 3: Fluid Dynamics & Aerodynamics

Q11. In a mountain-airfield exercise, According to Bernoulli's principle, when airflow speed over a wing increases, pressure generally:

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

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Q12. In a mountain-airfield exercise, Air flowing through a narrower part of a tube has a speed that is generally:

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

Q13. In a mountain-airfield exercise, The cross-sectional shape designed to generate lift is called a(n):

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

Q14. In a mountain-airfield exercise, Induced drag is most significant when an aircraft is flying at:

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

Q15. In a mountain-airfield exercise, Archimedes' principle is used to explain:

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

SECTION 4: Gas Laws & Thermodynamics

Q16. In a mountain-airfield exercise, Boyle's law relates pressure and volume when temperature is:

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

Q17. In a mountain-airfield exercise, At constant pressure, the volume of a gas is proportional to its:

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

Q18. In a mountain-airfield exercise, An ideal gas at 360 K is heated to 720 K at constant pressure. Its volume will:

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

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Q19. In a mountain-airfield exercise, Heat transfer through direct contact in a solid is called:

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

Q20. In a mountain-airfield exercise, 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. In a mountain-airfield exercise, A 24 V battery is connected to a 9 Ω resistor. Current?

- A) 2.67 A
- B) 3.00 A
- C) 1.00 A
- D) 6.00 A

Q22. In a mountain-airfield exercise, Two resistors of 10 Ω and 12 Ω are connected in series. Total resistance?

- A) 24 Ω
- B) 2 Ω
- C) 22 Ω
- D) 4 Ω

Q23. In a mountain-airfield exercise, The SI unit of electric charge is:

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

Q24. In a mountain-airfield exercise, A device that converts mechanical energy into electrical energy is a:

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

Q25. In a mountain-airfield exercise, In a parallel circuit, if one branch opens, the other branches generally:

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

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SECTION 6: Waves, Sound & Optics

Q26. In a mountain-airfield exercise, The unit of frequency is:

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

Q27. In a mountain-airfield exercise, An echo is produced mainly by:

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

Q28. In a mountain-airfield exercise, Which electromagnetic wave has the longest wavelength?

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

Q29. In a mountain-airfield exercise, Light changes direction when entering a different medium. This is:

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

Q30. In a mountain-airfield exercise, The speed of light in vacuum is approximately:

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

SECTION 7: Mechanics & Circular Motion

Q31. In a mountain-airfield exercise, The force directed toward the centre of circular motion is:

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

Q32. In a mountain-airfield exercise, A 11 kg object moving at 10 m/s has momentum:

- A) 20 kg·m/s
- B) 40 kg·m/s
- C) 110 kg·m/s
- D) 9 kg·m/s

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Q33. In a mountain-airfield exercise, An impulse equals force multiplied by:

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

Q34. In a mountain-airfield exercise, For a given mass, doubling angular speed makes rotational kinetic energy:

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

Q35. In a mountain-airfield exercise, Torque is calculated as force multiplied by perpendicular:

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

SECTION 8: Properties of Matter

Q36. In a mountain-airfield exercise, Density is defined as:

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

Q37. In a mountain-airfield exercise, Hooke's law applies within the elastic limit and relates force to:

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

Q38. In a mountain-airfield exercise, Pressure in a fluid is transmitted equally in all directions according to:

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

Q39. In a mountain-airfield exercise, A liquid changing into a gas at its surface is called:

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

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Q40. In a mountain-airfield exercise, A material with a fixed volume but no fixed shape is a:

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

SECTION 9: Aviation Science Applications

Q41. In a mountain-airfield exercise, At high altitude, air density is generally:

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

Q42. In a mountain-airfield exercise, A pitot-static system is used to sense:

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

Q43. In a mountain-airfield exercise, The primary effect of extending flaps during approach is to increase:

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

Q44. In a mountain-airfield exercise, Mach number is the ratio of aircraft speed to the local speed of:

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

Q45. In a mountain-airfield exercise, A stall occurs when the wing exceeds its critical:

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

SECTION 10: General Science & Calculations

Q46. In a mountain-airfield exercise, A 33 V circuit carries 5.0 A. Electrical power?

- A) 165.0 W
- B) 10 W
- C) 20 W
- D) 60 W

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Q47. In a mountain-airfield exercise, A lever lifts 700 N using an effort of 160 N. Mechanical advantage?

- A) 4.38
- B) 5.00
- C) 3.00
- D) 2.00

Q48. In a mountain-airfield exercise, An object falls from rest for 5.0 s. Using $g = 9.8 \text{ m/s}^2$, final speed is approximately:

- A) 49.0 m/s
- B) 9.8 m/s
- C) 19.6 m/s
- D) 29.4 m/s

Q49. In a mountain-airfield exercise, A force of 140 N acts over an area of 10 m^2 . Pressure?

- A) 100 Pa
- B) 14.0 Pa
- C) 20 Pa
- D) 40 Pa

Q50. In a mountain-airfield exercise, A hydraulic piston has area ratio 7:10. An input of 50 N produces an output force of:

- A) 71.4 N
- B) 20 N
- C) 300 N
- D) 100 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: C) 350,000 N

Explanation: Use $F = ma$.

Q3. Correct Answer: B) 5.0 m/s²

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

Q4. Correct Answer: C) Friction

Explanation: Friction opposes relative motion.

Q5. Correct Answer: C) Zero

Explanation: Constant velocity means zero acceleration.

Q6. Correct Answer: D) 8,400 J

Explanation: Use $W = Fd$.

Q7. Correct Answer: C) Gravitational potential energy

Explanation: Height gives gravitational potential energy.

Q8. Correct Answer: A) 484.0 J

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

Q9. Correct Answer: D) 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: D) 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: B) Low speed and high lift

Explanation: Induced drag is linked to lift generation.

Q15. Correct Answer: B) 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: B) Absolute temperature

Explanation: This is Charles's law.

Q18. Correct Answer: A) Double

Explanation: Volume is proportional to absolute temperature.

Q19. Correct Answer: C) Conduction

Explanation: Conduction transfers energy through contact.

Q20. Correct Answer: A) -273.15°C

Explanation: 0 K corresponds to -273.15°C .

Q21. Correct Answer: A) 2.67 A

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

Q22. Correct Answer: C) 22 Ω

Explanation: Series resistances add.

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Q23. Correct Answer: A) Series rotating frame due to inertia.

Explanation: Charge is measured in coulombs.

Q24. Correct Answer: B) Generator

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Explanation: A generator produces electrical output from motion.

Q25. Correct Answer: A) 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: B) Radio wave

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

Q29. Correct Answer: A) 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: D) Centripetal force

Explanation: Centripetal means centre-seeking.

Q32. Correct Answer: D) $110 \text{ kg}\cdot\text{m/s}$

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: B) Distance from the pivot

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

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Q36. Correct Answer: D) $1.56 \times 10^{-5} \text{ m}$

Explanation: $\rho = m/V$.

Q37. Correct Answer: D) 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: A) Evaporation

Explanation: Evaporation occurs at the surface.

Q40. Correct Answer: A) Liquid

Explanation: A liquid takes the shape of its container.

Q41. Correct Answer: D) 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: A) 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: B) 165.0 W

Explanation: Use $P = VI$.

Q47. Correct Answer: D) 4.38

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

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Q48. Correct Answer: A) 49.0 m/s

Explanation: Use $v = gt$.

Q49. Correct Answer: A) 14.0 Pa

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Explanation: Use $P = F/A$.

Q50. Correct Answer: B) 71.4 N