

# Celestial Kinematics and Human Performance

Physical Education And Space Science · Answer Key · 12 Questions

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**1. Which physiological effect occurs in the human body due to the prolonged microgravity environment of the International Space Station?**

- A) Increased bone density
- B) Shift of bodily fluids towards the head**
- C) Enhanced muscle hypertrophy
- D) Strengthening of the vestibular system

**2. How does the 'g-force' experienced by astronauts during high-velocity atmospheric re-entry affect blood distribution in the human body?**

- A) Blood pools in the feet, reducing oxygen to the brain**
- B) Blood pressure decreases significantly in the extremities
- C) Blood is evenly distributed throughout the pulmonary system
- D) Blood volume increases in the lower torso

**3. What is the primary purpose of the resistive exercise devices (ARED) used by astronauts during long-duration space missions?**

- A) To maintain aerobic endurance
- B) To counteract muscle atrophy and bone demineralization**
- C) To regulate body temperature in vacuum conditions
- D) To simulate the rotational gravity of Mars

**4. On the surface of Mars, which has approximately 38% of Earth's gravity, how would a standard vertical jump performed by a human be affected compared to Earth?**

- A) The peak height would be lower due to atmospheric drag
- B) The jump duration would be shorter
- C) The peak height would be significantly higher**
- D) The jump mechanics would remain identical

**5. What is the 'Kessler Syndrome' in relation to the physical environment of low Earth orbit?**

- A) A condition of extreme muscle stiffness in astronauts
- B) The theoretical chain reaction of debris collisions**
- C) A type of high-altitude vertigo
- D) The rate of oxygen consumption in a closed loop system

**6. Which specialized suit component is used in Extravehicular Activity (EVA) to combat the vacuum of space during physical exertion?**

**A) Liquid Cooling and Ventilation Garment (LCVG)**

- B) Pressurized carbon-fiber exoskeleton
- C) Active magnetic stabilization tether
- D) Thermal solar-reflecting kinetic shield

**7. During a parabolic flight, often called the 'Vomit Comet', how is weightlessness achieved for short durations of physical movement training?**

- A) By entering a vacuum chamber
- B) By traveling at the escape velocity of Earth
- C) By following a free-fall flight trajectory**
- D) By rotating the aircraft at supersonic speeds

**8. What is the impact of solar radiation on the physical safety of astronauts performing physical activity outside the ISS magnetosphere?**

- A) It creates an anti-gravity effect
- B) It can cause acute radiation syndrome and cellular damage**
- C) It increases the grip strength of mechanical gloves
- D) It accelerates the cooling rate of the suit

**9. Which sensory system, essential for physical balance on Earth, experiences the most significant disorientation during the transition to microgravity?**

- A) The gustatory system
- B) The proprioceptive system
- C) The vestibular system**
- D) The endocrine system

**10. What is the escape velocity required for a human-crewed spacecraft to physically break free from Earth's gravitational pull?**

- A) Approximately 11.2 km/s**
- B) Approximately 7.9 km/s
- C) Approximately 1.5 km/s
- D) Approximately 25.0 km/s

**11. In the context of planetary exercise, what is the 'Hill Sphere' of a planet?**

- A) The region where the planet's gravity dominates the motion of satellites**
- B) The highest point of physical elevation on the planet's surface
- C) The angle of inclination for optimal physical training
- D) The orbital distance where human breathing is impossible

**12. Which law of physics explains why an astronaut spinning in a microgravity environment must tuck their arms inward to increase their rotational velocity?**

A) Law of Universal Gravitation

**B) Conservation of angular momentum**

C) Newton's Third Law of Motion

D) The Bernoulli Principle