Cosmic Calculations: Advanced Math in Space

Basic Math · Practice Test · 10 Questions

1. The gravitational constant, G, is approximately 6.674 × 10?¹¹ N·m²/kg². If two objects with masses of 1 kg each are separated by 1 meter, what is the approximate gravitational force between them?

A) 6.674 × 10?¹¹ N
B) 6.674 × 10?9 N
C) 6.674 × 10?¹³ N
D) 1 N

2. Earth's approximate equatorial diameter is 12,756 km. If the Moon's diameter is roughly 3,474 km, what is the ratio of Earth's diameter to the Moon's diameter, rounded to two decimal places?

A) 3.67
B) 0.27
C) 4.00
D) 2.50

3. The average distance from Earth to the Sun is about 149.6 million kilometers (1 Astronomical Unit). Light travels at approximately 300,000 km/s. How many seconds does it take for sunlight to reach Earth?

A) 498.7 seconds
B) 4987 seconds
C) 49.87 seconds
D) 49870 seconds

4. Jupiter's mass is approximately 1.898 × 10²7 kg, and Saturn's mass is approximately 5.683 × 10²6 kg. What is the ratio of Jupiter's mass to Saturn's mass, rounded to one decimal place?

A) 3.3
B) 0.3
C) 10.5
D) 5.7

5. The surface temperature of the Sun's photosphere is approximately 5,778 Kelvin. If we consider this a blackbody radiator, and using Wien's displacement law (?_max = b/T, where b ? 2.898 × 10?³ m·K), what is the approximate peak wavelength of the Sun's radiation in nanometers?

A) 500 nm
B) 200 nm
C) 5000 nm
D) 50 nm

6. The speed of light in a vacuum is approximately 299,792 kilometers per second. Proxima Centauri, the closest star to our Sun, is about 4.24 light-years away. How many kilometers is this distance (using 1 light-year ? 9.461 × 10^{12} km)?

A) 4.01 × 10^{13} km
B) 4.01 × 10^{1}0 km
C) 4.01 × 10^{1}6 km
D) 4.01 × 10^{12} km

7. If the observable universe has an estimated diameter of about 93 billion light-years, and this is represented by a sphere, what is the approximate volume of the observable universe in cubic light-years (using V = 4/3 * ? * r³)?

A) 4.19 × 10^{32} cubic light-years
B) 1.39 × 10^{33} cubic light-years
C) 3.14 × 10^{33} cubic light-years
D) 1.05 × 10^{32} cubic light-years

8. Mars has an average orbital radius of approximately 228 million kilometers. If its orbital speed is about 24.13 km/s, what is the approximate orbital period of Mars in days (consider 1 day = 86,400 seconds)?

A) 687 days
B) 365 days
C) 400 days
D) 500 days

9. The average density of water is 1000 kg/m³. The average density of Jupiter is approximately 1326 kg/m³. What is the ratio of Jupiter's density to water's density, rounded to two decimal places?

A) 1.33
B) 0.75
C) 2.33
D) 1000.00

10. The escape velocity from Earth's surface is approximately 11.2 km/s. If a spacecraft needs to achieve this velocity, and its current velocity is 5.6 km/s, by what factor would its current kinetic energy (KE ? v²) need to increase to reach escape velocity?

A) 4 times
B) 2 times
C) ?2 times
D) 1/2 times