Name: _____

Date: _____

UASPACE's CubeSat Space Science

ESS.4.1, ESS.4.2, ESS.4.3, ESS.4.4

1. UASPACE's BAMA-1 CubeSat will orbit around the Earth with an orbit radius of 2,000 kilometers (2,000,000 meters). If this satellite has a mass of 8 kg, use Newton's Law of Universal Gravitation to determine the gravitational force it experiences. (Hint: Earth's mass is 5.972 × 10^24 kg)

   Given:
   m1 = 8 kg
   m2 = 5.972 × 10^24 kg
   r = 2,000,000 m
   G (gravitational constant) = 6.67408 × 10^-11

   Find:
   Force of gravity

   Hint:
   F = G*(m1*m2) / r^2

2. Match the following orbital laws with their names.
   _____ Kepler's 1st Law
   _____ Newton's 1st Law of Motion
   _____ Newton's 2nd Law of Motion
   _____ Newton's 3rd Law of Motion
   _____ Newton's Law of Universal Gravitation

   A. Every action or force has an equal and opposite reaction

   B. F = G*(m1*m2) / r^2 **C.** An object in motion stays in motion **D.** F = m*a

   E. The orbit of every planet is an ellipse with the sun at one of the foci

Name: _____

Date: _____

UASPACE's CubeSat Space Science Solutions

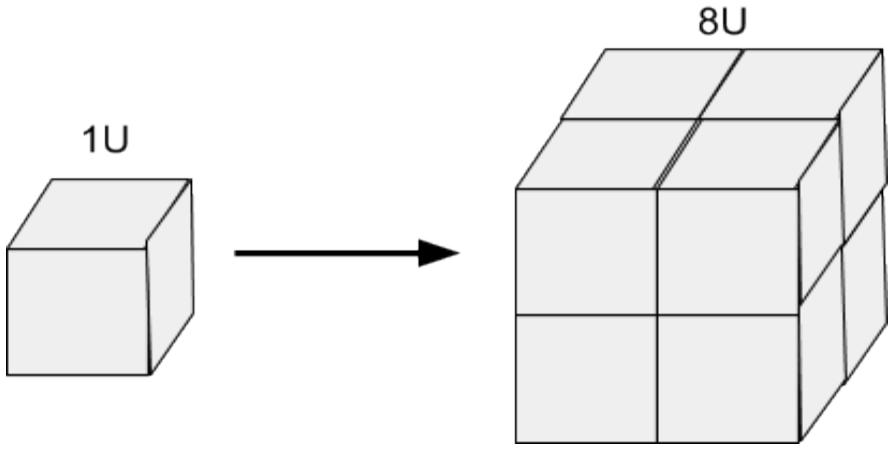
1. 797.1521152 Newtons
2. E, C, D, A, B

Name: _____

Date: _____

UASPACE's CubeSat Geometry

1. A 1U CubeSat is shown below. It has a side length of 10 cm and weighs 1.33 kg. eight 1U CubeSats can be combined to create an 8U CubeSat



Calculate and compare the following for the two CubeSats.

	1U	8U
Volume		
Surface Area		
Mass		
Density		

Name: _____

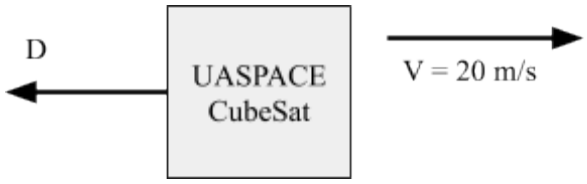
Date: _____

UASPACE's CubeSat Physics

PS.7.2, PS.8.3

1. A CubeSat with a mass of 1 kg is traveling at 200 meters per second in orbit. Assume no external forces except drag. The CubeSat experiences a drag force of 5 Newtons in the opposite direction of the velocity. How long will it take for the CubeSat to slow down to a velocity of zero?

   Given:
   Vinit = 200 m/s
   Vfinal = 0 m/s
   D = 5 N
   m = 10 kg

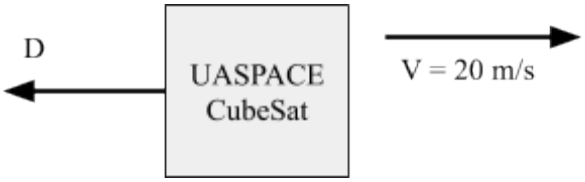
   

   Find:
   Δt

   Hint:
   F = m*a
   a = ΔV / Δt
   ΔV = Vfinal - Vinitial

2. Now, with the drag sail deployed, the CubeSat experiences a drag force of 50 Newtons in the opposite direction of the velocity. How long will it take to slow to a velocity of zero?

   Given:
   Vinit = 20 m/s
   D = 50 N

   Find:
   Δt

3. When an object slows down in orbit, it is able to fall back into Earth's atmosphere, and prevents satellite garbage from gathering in orbit. If the goal of

Name: _____

Date: _____

UASPACE's CubeSat is to fall out of orbit quickly, should it use a drag sail or no drag sail?

Name: _____

ANSWER KEY

Date: _____

UASPACE's CubeSat Physics Solutions

1. 4000 seconds
2. 400 seconds
3. With drag sail

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Name: _____

Date: _____

UASPACE's CubeSat Data Interpretation

Graphing Data and Calculating Trends

1. UASPACE's CubeSat has been in orbit for 14 days. The CubeSat is sending data on its orbital altitude back to the team on Earth. Data from the last 14 days is in the table below.

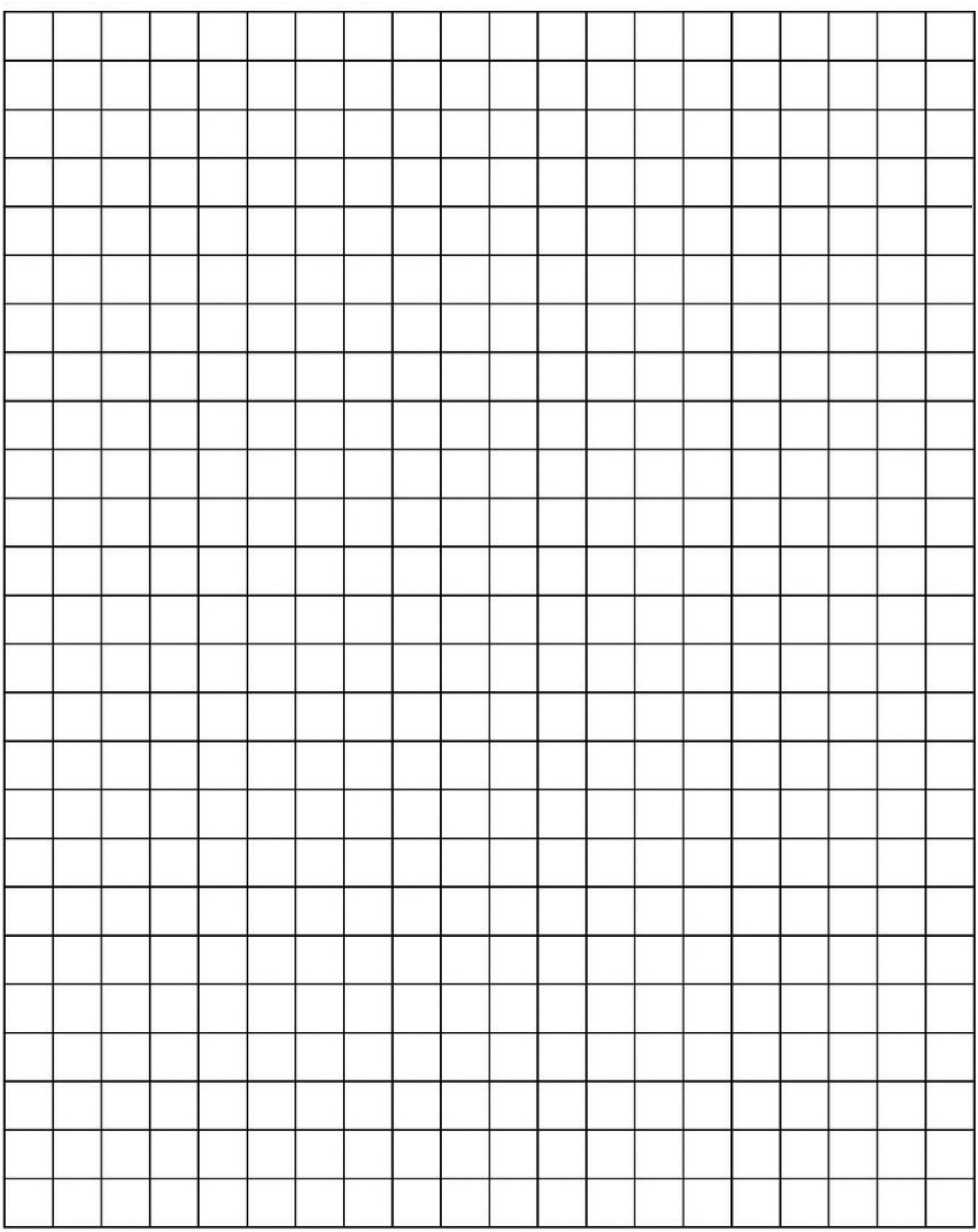
Day	Altitude (kilometers)
1	2000
2	1982
3	1965
4	1944
5	1929
6	1911
7	1892
8	1875
9	1854

Once the satellite reaches 200 kilometers, it will burn up in the atmosphere.

Graph the data presented on the table and estimate how long it will take for the satellite to reach 200 kilometers. (graph paper included on the following page)

Name: _____

Date: _____



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