

Zoe's Valentine Gravity Quest

Grade 5

science

valentines-day

Students will be able to explain how gravity pulls all objects toward Earth and affects the motion and weight of objects based on mass.

Name: _____

Date: _____

1. Zoe finds a giant Valentine's card on the floor of her science lab. She picks it up and feels it pull back toward the ground. What force is pulling the card DOWN toward Earth? Circle the correct answer: (A) magnetism (B) gravity (C) wind (D) friction

2. Zoe holds a small heart-shaped eraser above her desk and lets go. She observes it falls straight DOWN. True or false: Gravity pulls objects toward the center of Earth. Write TRUE or FALSE and one reason why.

3. Zoe discovers a rare find — a hidden treasure box of Valentine chocolates on a high shelf. She notices heavier boxes are harder to lift. Fill in the blank: The greater an object's _____, the stronger Earth's gravitational pull on it, giving it more weight.

4. Zoe is testing two unique items: a full Valentine candy bag and an empty one. She drops both from the same height at the same time. She observes both bags hit the ground at nearly the same moment. What does this tell Zoe about how gravity works on objects of different masses?

5. Zoe finds a special object — a Valentine balloon filled with helium floating near the ceiling. She also sees a heart-shaped rock sitting on the table. Explain why the rock stays on the table but the balloon floats up. Use the word 'gravity' and 'mass' in your answer.

6. Zoe designs an experiment. She drops a small chocolate box (mass: low) and a large chocolate box (mass: high) from the same height. Her hypothesis is: 'The heavier box will hit the ground first.' After dropping both, they land at the same time. Was Zoe's hypothesis supported? Explain what the result shows about gravity and mass. Use evidence from her observation.

7. Zoe reads that the Moon has about one-sixth the gravity of Earth. She brings her Valentine hidden treasure — a 12-newton heart-shaped locket — to compare its weight on Earth versus the Moon. On Earth it weighs 12 newtons. Zoe predicts its Moon weight. What would the locket weigh on the Moon, and WHY does gravity differ between Earth and the Moon? Explain using the concept of mass of a planet or moon.

8. Zoe completes her Valentine gravity quest! She wants to send a heart-shaped satellite into orbit as a gift to the whole school. Mission control tells her: 'Orbit happens when a satellite moves fast enough that it keeps falling toward Earth but Earth's surface curves away beneath it.' Zoe wonders — if gravity suddenly switched off, what would happen to her satellite in orbit? Use what you know about gravity, inertia, and circular motion to explain. Then describe one real-world example of gravity keeping something in orbit around a larger object.

Answer Key: Zoe's Valentine Gravity Quest

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Before Q6, hold up two classroom objects of different mass and ask students to predict which hits the floor first when dropped — this directly mirrors Zoe's chocolate-box drop experiment in Q6 and sparks great debate.

1. Zoe finds a giant Valentine's card on the floor of her science lab. She picks it up and feels it pull back toward the ground. What force is pulling the card DOWN toward Earth? Circle the correct answer: (A) magnetism (B) gravity (C) wind (D) friction

Answer: Q1: The force pulling the card toward Earth is gravity. Gravity is the force that pulls all objects with mass toward Earth's center. Correct answer: (B) gravity.

2. Zoe holds a small heart-shaped eraser above her desk and lets go. She observes it falls straight DOWN. True or false: Gravity pulls objects toward the center of Earth. Write TRUE or FALSE and one reason why.

Answer: Q2: TRUE. Gravity always pulls objects downward toward Earth's center. This is why the eraser fell straight down and not sideways or upward. Gravity acts on all objects with mass near Earth.

3. Zoe discovers a rare find — a hidden treasure box of Valentine chocolates on a high shelf. She notices heavier boxes are harder to lift. Fill in the blank: The greater an object's _____, the stronger Earth's gravitational pull on it, giving it more weight.

Answer: Q3: The greater an object's MASS, the stronger Earth's gravitational pull on it, giving it more weight. Mass is the amount of matter in an object. More mass means gravity pulls harder on that object, increasing its weight.

4. Zoe is testing two unique items: a full Valentine candy bag and an empty one. She drops both from the same height at the same time. She observes both bags hit the ground at nearly the same moment. What does this tell Zoe about how gravity works on objects of different masses?

Answer: Q4: This tells Zoe that gravity pulls all objects toward Earth at the same rate regardless of their mass, when air resistance is very small. Both bags fell at nearly the same time because gravity accelerates all objects equally near Earth's surface. This supports the scientific idea that gravity's acceleration does not depend on an object's mass alone.

5. Zoe finds a special object — a Valentine balloon filled with helium floating near the ceiling. She also sees a heart-shaped rock sitting on the table. Explain why the rock stays on the table but the balloon floats up. Use the word 'gravity' and 'mass' in your answer.

Answer: Q5: The rock has much greater mass than the helium inside the balloon. Gravity pulls strongly on the rock's large mass, keeping it on the table. The helium balloon has very low mass and the upward push of air (buoyancy) is greater than the downward pull of gravity on it, so it floats. Gravity acts on both objects, but the rock's greater mass means gravity's pull wins over buoyancy, while the balloon's low mass means buoyancy wins.

6. Zoe designs an experiment. She drops a small chocolate box (mass: low) and a large chocolate box (mass: high) from the same height. Her hypothesis is: 'The heavier box will hit the ground first.' After dropping both, they land at the same time. Was Zoe's hypothesis supported? Explain what the result shows about gravity and mass. Use evidence from her observation.

Answer: Q6: Zoe's hypothesis was NOT supported. Her observation showed both boxes landed at the same time despite having different masses. This evidence shows that near Earth's surface, gravity accelerates all objects at the same rate (about 9.8 m/s^2 downward) regardless of mass.

The result disproves the common misconception that heavier objects fall faster. Zoe's experiment supports the scientific understanding that gravitational acceleration is constant for all masses near Earth.

7. Zoe reads that the Moon has about one-sixth the gravity of Earth. She brings her Valentine hidden treasure — a 12-newton heart-shaped locket — to compare its weight on Earth versus the Moon. On Earth it weighs 12 newtons. Zoe predicts its Moon weight. What would the locket weigh on the Moon, and WHY does gravity differ between Earth and the Moon? Explain using the concept of mass of a planet or moon.

Answer: Q7: Moon weight calculation: $12 \text{ newtons} \div 6 = 2 \text{ newtons on the Moon}$. The locket would weigh 2 newtons on the Moon. Gravity differs because the Moon has much less mass than Earth. Gravity depends on the mass of the planet or moon pulling the object. Earth's larger mass creates a stronger gravitational pull, giving objects more weight. The Moon's smaller mass creates weaker gravity, so the same locket weighs only one-sixth as much there. The locket's own mass does not change — only its weight changes because the gravitational pull on it is weaker.

8. Zoe completes her Valentine gravity quest! She wants to send a heart-shaped satellite into orbit as a gift to the whole school. Mission control tells her: 'Orbit happens when a satellite moves fast enough that it keeps falling toward Earth but Earth's surface curves away beneath it.' Zoe wonders — if gravity suddenly switched off, what would happen to her satellite in orbit? Use what you know about gravity, inertia, and circular motion to explain. Then describe one real-world example of gravity keeping something in orbit around a larger object.

Answer: Q8: If gravity switched off, Zoe's satellite would no longer be pulled toward Earth. Without gravity's inward pull, the satellite's inertia would carry it in a straight line off into space — it would fly away from Earth in whatever direction it was moving at that moment. This is because inertia keeps moving objects moving in a straight line unless a force acts on them. Gravity is that force — it constantly bends the satellite's straight-line path into a curve, creating orbit. Real-world example: Earth itself orbits the Sun because the Sun's enormous mass creates gravitational pull that keeps Earth curving around it rather than flying off into space. Zoe's mission teaches us that gravity is the invisible force holding our entire solar system together — and it was working all along, even while she delivered Valentine science to her school!