Instructions

Read each question carefully. For Part A, circle the correct answer or fill in the blank using the word bank. For Part B, write your answer in complete sentences. For Part C, show your calculations to find the answer. Good luck!

Part A: Objective Questions

Instructions: For questions 1-12, circle the letter of the best answer. For questions 13-16, choose the best statement and mark it as True or False.

1. The amount of "stuff" or matter that makes up an object is its:
    - a) Weight
    - b) Mass
    - c) Gravity
    - d) Volume
2. What is the standard unit for measuring **weight**?
    - a) Kilogram (kg)
    - b) Meter (m)
    - c) Newton (N)
    - d) Liter (L)
3. The force of attraction between any two objects that have mass is called:
    - a) Friction
    - b) Magnetism
    - c) Inertia
    - d) Gravity
4. Which instrument is typically used to measure **mass**?
    - a) Spring scale
    - b) Balance scale
    - c) Thermometer
    - d) Barometer
5. If you travel to Jupiter, where gravity is much stronger than on Earth, what will happen?
    - a) Your mass will increase.
    - b) Your weight will increase.
    - c) Your mass will decrease.
    - d) Your weight will decrease.
6. What is the standard unit for measuring **mass**?
    - a) Newton (N)
    - b) Liter (L)
    - c) Kilogram (kg)
    - d) Joule (J)
7. Which of the following is a measure of a force?
    - a) Mass
    - b) Volume
    - c) Weight
    - d) Density
8. Which instrument is used to measure **weight**?
    - a) Spring scale
    - b) Measuring cup
    - c) Balance scale
    - d) Ruler
9. An object's weight is the measure of the force of _____ acting on its mass.
    - a) friction

    - b) air resistance
    - c) magnetism
    - d) gravity
10. The strength of gravity depends on two main things:
    - a) Mass and temperature
    - b) Mass and distance
    - c) Weight and speed
    - d) Weight and distance
11. An astronaut floating in the International Space Station is experiencing:
    - a) No gravity
    - b) Zero mass
    - c) Microgravity (a very weak gravitational force)
    - d) Negative gravity
12. An object with more mass has _____ inertia.
    - a) less
    - b) more
    - c) the same
    - d) zero
13. **True or False:** Your mass would be different if you were on the Moon.
14. **True or False:** An object with a large mass will have a smaller weight than an object with a small mass (if both are on Earth).
15. **True or False:** Weight is constant no matter where you are in the universe.
16. **True or False:** In a vacuum (a space with no air), a bowling ball and a feather dropped from the same height will hit the ground at the same time.

Instructions: For questions 17-20, complete the sentences using the words from the word bank below. You will use each word once.

Word Bank: Force, kg, N, stronger

17. Weight is a type of _____.
18. The more mass an object has, the _____ its gravitational pull is.
19. The symbol for the kilogram, the standard unit of mass, is _____.
20. The symbol for the Newton, the standard unit of weight, is _____.

Part B: Subjective Questions

Instructions: Answer the following questions in one or two complete sentences.

1. In your own words, explain the main difference between mass and weight.
2. Why does an astronaut weigh less on the Moon than on Earth, even though their mass stays the same?
3. If you take a rock from the Moon and bring it to Earth, what happens to the rock's mass and weight? Explain why.
4. What two factors determine the strength of the gravitational force between two objects?
5. Is it possible for an object to have mass but no weight? Explain your answer.
6. Why do we feel "stuck" to the Earth and not to a person standing next to us, even though all objects with mass have gravity?
7. Imagine you simultaneously drop a crumpled ball of paper and a flat sheet of paper. Which one hits the ground first and why?
8. Describe what would happen to your weight if the Earth's mass suddenly doubled but its size stayed the same.
9. Why is a balance scale (which compares two masses) a better tool for measuring mass than a

spring scale (which measures weight)?
10. What is inertia, and how is it related to mass?

Part C: Problem-Solving

Instructions: Solve the following problems. Show your work!

Remember the formula: Weight (N) = Mass (kg) × Gravitational Field Strength (g)
On Earth, use g = 9.8 N/kg

1. A large science textbook has a mass of 3 kg. What is its weight on Earth?

2. An astronaut and their spacesuit have a total mass of 120 kg. What is their weight on Earth?

3. A dog weighs 196 N on Earth. What is its mass? (Hint: You will need to rearrange the formula.)

4. The gravitational field strength on the Moon is much lower, only 1.6 N/kg. What would be the weight of the 120 kg astronaut (from question #2) on the Moon?

5. You are carrying a backpack with a mass of 5 kg and a bag of groceries with a mass of 7.5 kg. What is the total weight you are carrying on Earth?

Answer Key

Part A: Objective Questions

1. b) Mass
2. c) Newton (N)
3. d) Gravity
4. b) Balance scale
5. b) Your weight will increase.
6. c) Kilogram (kg)
7. c) Weight
8. a) Spring scale
9. d) gravity
10. b) Mass and distance
11. c) Microgravity (a very weak gravitational force)
12. b) more
13. **False.** Mass is the amount of matter and does not change based on location.
14. **False.** An object with more mass has more weight on the same planet.
15. **False.** Weight depends on gravity, so it changes depending on where you are.
16. **True.** Without air resistance, all objects fall at the same rate due to gravity.
17. Force
18. stronger
19. kg
20. N

Part B: Subjective Questions (Sample Answers)

1. Mass is the amount of matter in an object and is measured in kilograms (kg), while weight is

the force of gravity pulling on that mass and is measured in Newtons (N).
2. The astronaut weighs less on the Moon because the Moon has less mass than the Earth, which creates a weaker gravitational pull.
3. The rock's mass would stay the same because it still has the same amount of matter. Its weight would increase because Earth's gravity is much stronger than the Moon's.
4. The strength of gravity depends on the mass of the two objects and the distance between them.
5. Yes. In deep space, far away from any planets or stars, an object would have virtually no gravitational force acting on it, so it would be weightless but still have mass.
6. We feel Earth's gravity because the Earth has an enormous mass. The gravitational pull between people is incredibly tiny and not noticeable.
7. The crumpled ball of paper will hit the ground first. This is because the flat sheet has more surface area and experiences much more air resistance, which slows its fall.
8. If Earth's mass doubled, the force of gravity would also double. Therefore, your weight would double.
9. A balance scale works anywhere because it compares an unknown mass to a known mass, and gravity pulls on both sides equally. A spring scale's measurement would change depending on the local force of gravity.
10. Inertia is an object's resistance to a change in its motion. The more mass an object has, the more inertia it has (it's harder to start or stop it from moving).

Part C: Problem-Solving

1. Weight = 3 kg × 9.8 N/kg = **29.4 N**
2. Weight = 120 kg × 9.8 N/kg = **1176 N**
3. Mass = Weight / g = 196 N / 9.8 N/kg = **20 kg**
4. Weight on Moon = 120 kg × 1.6 N/kg = **192 N**
5. Total Mass = 5 kg + 7.5 kg = 12.5 kg
   Total Weight = 12.5 kg × 9.8 N/kg = **122.5 N**