

Chapter 12 Universal Gravitation

# Gravitational Interactions

## Pre-Test - Post-Test

1. Where would your weight be the greatest?
 

|                                 |                                       |
|---------------------------------|---------------------------------------|
| A) On top of a tall mountain.   | C) In a tunnel deep inside the Earth. |
| B) On the surface of the Earth. | D) None of the above                  |
  
2. A supplier wants to make a profit by buying metal by weight at one altitude and selling it at the same price per pound at another altitude. The supplier should
  - A) buy at a high altitude and sell at a low altitude.
  - B) buy at a low altitude and sell at a high altitude.
  - C) disregard altitude because it makes no difference when dealing with weight.
  
3. Half way to the center of a planet of uniform density, your weight compared to your weight at the surface would be \_\_\_\_\_.
 

|                                    |                                    |
|------------------------------------|------------------------------------|
| A) the same as your normal weight. | C) one-half your normal weight.    |
| B) double your normal weight.      | D) one-quarter your normal weight. |
  
4. If you drop a stone into a tunnel drilled all the way through and out the other side of the earth the stone will \_\_\_\_\_.
  - A) come to an abrupt stop at the center of the earth.
  - B) speed up until it gets to the center of the earth.
  - C) speed up until it reaches the other side of the earth.
  - D) slow down until it comes to a stop in the middle of the earth.
  
5. If the sun collapsed and formed a black hole, what would happen to the earth?
  - A) It would be pulled into the black hole because of the increased surface gravity.
  - B) The Earth's orbital speed would increase because of the strong surface gravity.
  - C) The Earth would fly off tangent to its current orbital path.
  - D) Nothing would happen to the earth because the sun's total mass and the location of the sun's center of gravity have not changed.
  
6. Which pulls on the earth's oceans with a greater force?
 

|             |                       |
|-------------|-----------------------|
| A) the sun  | C) both pull the same |
| B) the moon |                       |
  
7. Ocean tides occur mainly because \_\_\_\_\_.
  - A) water normally runs to the side of Earth away from the sun.
  - B) of the gravitational pull of the sun on Earth.
  - C) of different gravitational pulls of the moon on opposite sides of Earth.
  - D) as Earth rotates it leaves the ocean water somewhat behind it.

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## Gravitational Fields

1. On the image below, draw the gravitational field around the Earth.



4. What is the value of the gravitational field of the Earth at its center?

5. For a rock falling through a tunnel cut through the Earth, where would its speed be the greatest?

6. How long does it take an object to orbit the Earth?

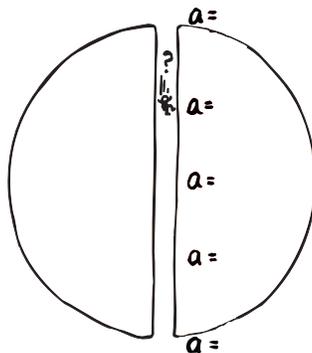
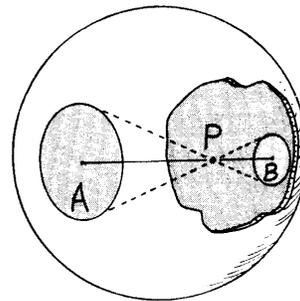
7. How long would it take to travel through the tunnel cut through the center of the Earth? How long for a round trip through the same tunnel?

## Gravitational Field Inside a Planet

2. If the Earth were of uniform composition, would your weight increase or decrease at the bottom of a deep mine shaft?

8. How is gravity affected by a hollow planet inside and out?

3. A tunnel is dug all the way through the Earth and out the other side as pictured below, write in the acceleration at each location. What would happen to your speed if you jumped into the tunnel?



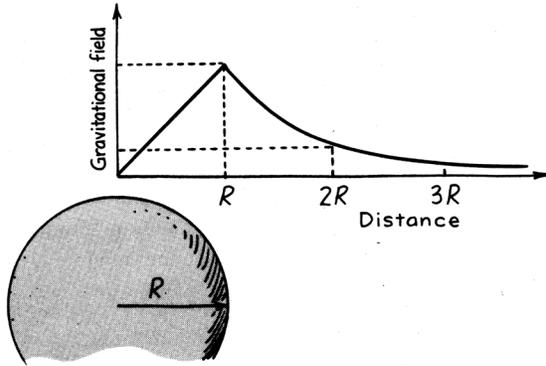
9. You weigh a tiny bit less when you are in the lobby of a massive skyscraper. Discuss

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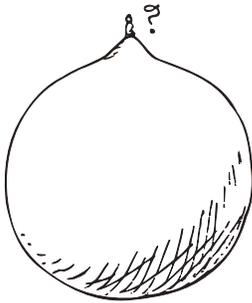


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10. How does your weight change, or not, as you move away from the center of the Earth and where do you weigh the most?



11. Is the acceleration of gravity more, less, or the same at the top of Mt. Everest? Explain

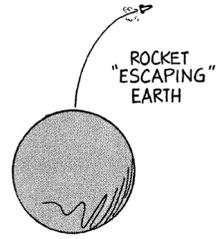


12. If you stood atop a ladder that was so tall that you doubled your distance from Earth's center, how would your weight compare with its present value?

13. Where on Earth would you weigh less than you do at this moment?

### Escape Velocity

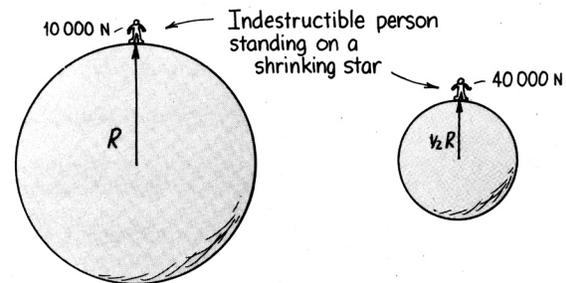
14. What is escape speed?



15. What is the escape speed on the surface of the Earth?

16. What is the escape speed on the surface of the Sun?

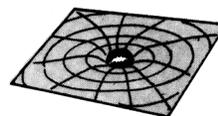
17. If the Earth shrank with no change in its mass, what would happen to your weight at the surface?



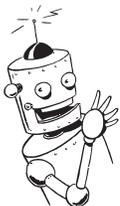
18. If the Earth shrank with no change in its mass, what would happen to its escape speed?

### Relativity

19. Newton explained the curving path of a planet around the Sun as being caused by a force acting on the planet. How did Einstein explain the curving path of a planet around the Sun?

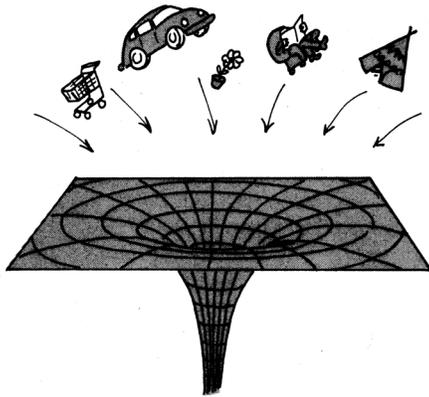


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**Chapter 12 Universal Gravitation**

**Black Holes**

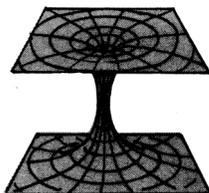


20. Discuss the forces that establish a star's size.

21. What would happen to the escape speed on the surface of a star that is collapsing?

22. What is a black hole?

23. What is a worm hole?

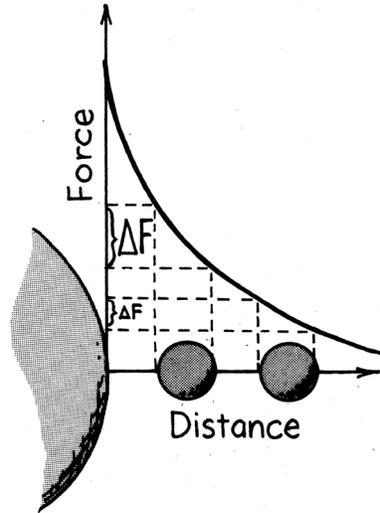


24. If the Sun did turn into a black hole, what effect would there be on the orbital path of the Earth?

**Tidal Forces**

25. Which pulls harder on the oceans, the Moon or the Sun?

26. Which plays a greater role in raising Earth's tides, the Sun or the Moon? Explain



27. How many high tides and low tides are there in a day?



28. What is the main cause for the tides on the Earth?

29. Why is one side of the Earth pulled harder by the Moon than the other side?

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30. Why are all tides greatest at time of a full or new Moon?



37. How do tides effect our atmosphere?

38. Why do your friends exhibit strange behavior during a full moon?

31. Do tides depend more on the strength of gravitational pull or on the difference in strengths? Explain.

32. If the Moon did not exist would we still have tides?

33. Is there any cause for alarm if the Moon passes too close to the Earth?

34. If somebody tugged on your shirt sleeve, it would likely tear. But if all parts of your shirt were tugged equally, no tearing would occur. How does this relate to tidal forces?

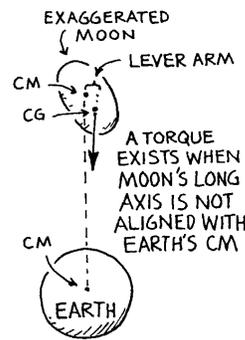
35. A person falling into a black hole would probably be killed by tidal forces long before they ever encountering the surface of the black hole. Explain.

36. When do you think there is the highest probability of having an earthquake? Explain.

**Torque and Gravity**

39. How many times does the Moon rotate on its axis?

40. Why does one side of the Moon always face the Earth?



41. Discuss the big bang and the theory of an oscillating universe.

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