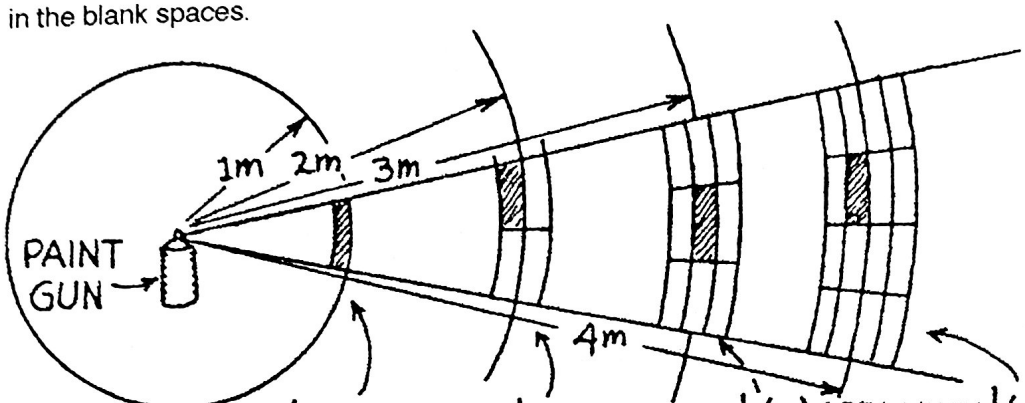
Name _____ Date _____

CONCEPTUAL Physics PRACTICE PAGE

Chapter 9 Gravity

Inverse-Square Law

1. Paint spray travels radially away from the nozzle of the can in straight lines. Like gravity, the strength (intensity) of the spray obeys an inverse-square law. Complete the diagram by filling in the blank spaces.

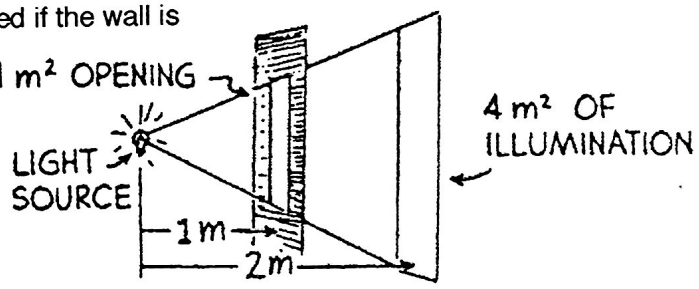


	1 AREA UNIT	4 AREA UNITS	( ) AREA UNITS	( ) AREA UNITS
PAINT SPRAY	1 mm THICK	¼ mm THICK	( ) mm THICK	( ) mm THICK

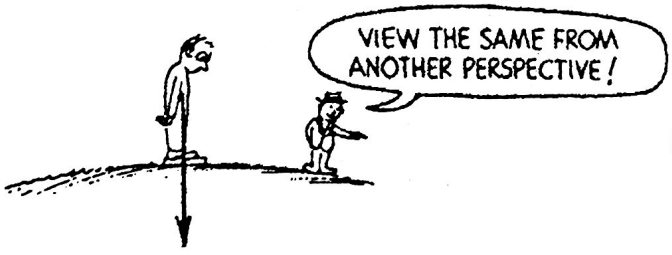
2. A small light source located 1 m in front of an opening of area 1 m^2 illuminates a wall behind. If the wall is 1 m behind the opening (2 m from the light source), the illuminated area covers 4 m^2. How many square meters will be illuminated if the wall is

5 m from the source? _____

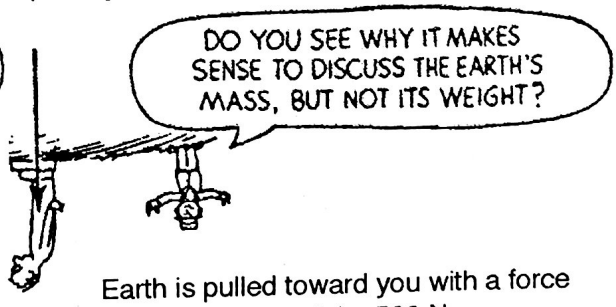
10 m from the source? _____



3. If you stand at rest on a weighing scale and find that you are pulled toward Earth with a force of 500 N, then the normal force on the scale is also _____ N and you weigh _____ N. How much does Earth weigh? If you tip the scale upside down and repeat the weighing process, you and Earth are still pulled together with a force of _____ N, and therefore, relative to you, the whole 6,000,000,000,000,000,000,000,000-kg Earth weighs _____ N! Weight, unlike mass, is a relative quantity.



You are pulled to Earth with a force of 500 N, so you weigh 500 N.



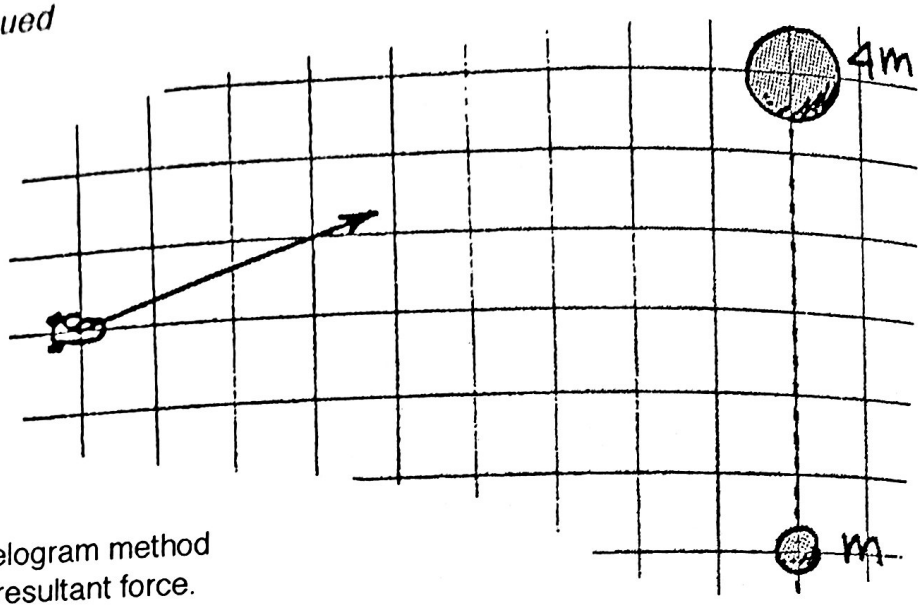
Earth is pulled toward you with a force of 500 N, so it weighs 500 N.

Hewitt Drew It!

Chapter 9 Gravity

Inverse-Square Law—continued

4 The spaceship is attracted to both the planet and the planet's moon. The planet has four times the mass of its moon. The force of attraction of the spaceship to the planet is shown by the vector.

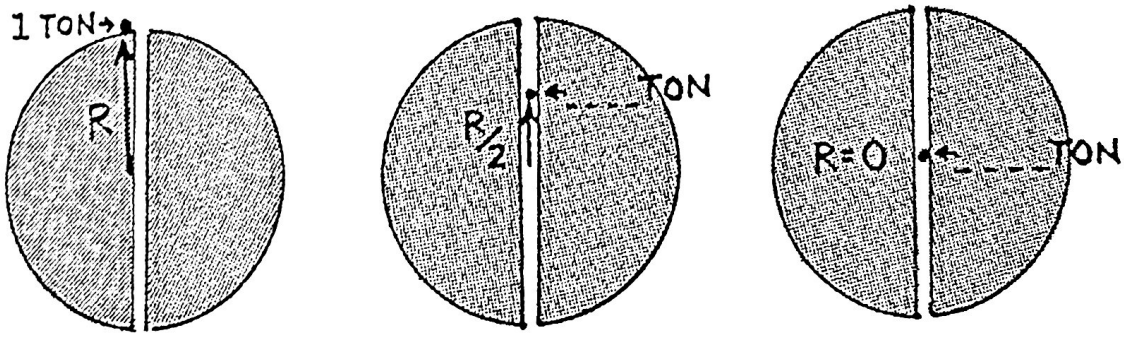


a. Carefully sketch another vector to show the spaceship's attraction to the moon. Then apply the parallelogram method of Chapter 3 and sketch the resultant force.

b. Determine the location between the planet and its moon (along the dotted line) where gravitational forces cancel. Make a sketch of the spaceship there.

5. Consider a planet of uniform density that has a straight tunnel from the North Pole through the center to the South Pole. At the surface of the planet, an object weighs 1 ton.

a. Fill in the gravitational force on the object when it is halfway to the center, then at the center.



b. Describe the motion you would experience if you fell into the tunnel.

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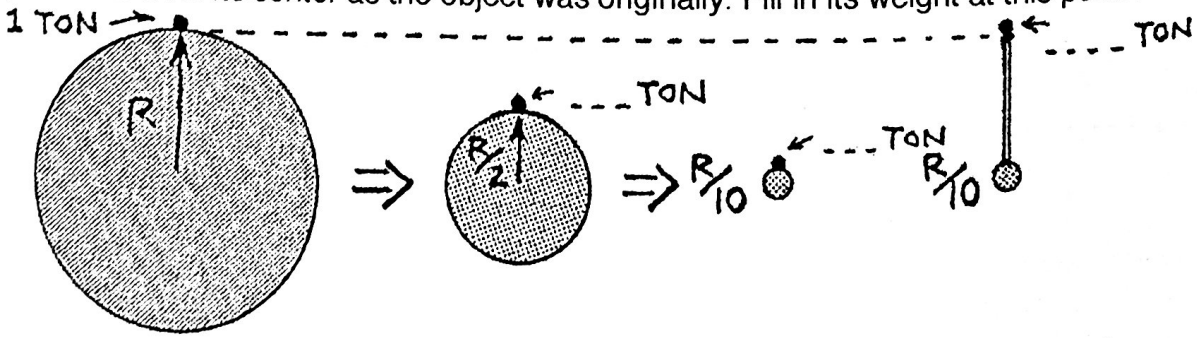
6. Consider an object that weighs 1 ton at the surface of a planet, just before the planet gravitationally collapses.

a. Fill in the weights of the object on the planet's shrinking surface at the radial values shown.

b. When the planet has collapsed to 1/10 of its initial radius, a ladder is erected that puts the object as far from its center as the object was originally. Fill in its weight at this position.



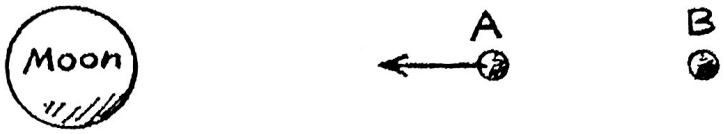
Name _____ Date _____

CONCEPTUAL Physics PRACTICE PAGE

Chapter 9 Gravity

Our Ocean Tides

1. Consider two equal-mass blobs of water, A and B, initially at rest in the Moon's gravitational field. The vector shows the gravitational force of the Moon on A.



a. Draw a force vector on B due to the Moon's gravity.

b. Is the force on B more or less than the force on A? _____

c. Why? _____

d. The blobs accelerate toward the Moon. Which has the greater acceleration? [A] [B]

e. Because of the different accelerations, with time

[A gets farther ahead of B] [A and B gain identical speeds] and the distance between A and B

[increases] [stays the same] [decreases].

f. If A and B were connected by a rubber band, with time the rubber band would

[stretch] [not stretch].

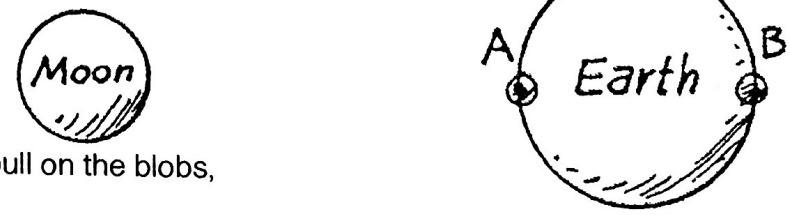
g. This [stretching] [nonstretching] is due to the [difference] [nondifference] in the Moon's gravitational pulls.

h. The two blobs will eventually crash into the Moon. To orbit around the Moon instead of crashing into it, the blobs should move

[away from the Moon] [tangentially]. Then their accelerations will consist of changes in

[speed] [direction].

2. Now consider the same two blobs located on opposite sides of Earth.



a. Because of difference in the Moon's pull on the blobs,

they tend to [spread away from each other] [approach each other].

b. Does this spreading produce ocean tides? [Yes] [No]

c. If Earth and Moon were closer, gravitational force between them would be

[more] [the same] [less], and the difference in gravitational forces on the near and far parts

of the ocean would be [more] [the same] [less].

d. Because Earth's orbit about the Sun is slightly elliptical, Earth and Sun are closer in December than in June. Taking the Sun's tidal force into account, on a world average, ocean tides are

greater in [December] [June] [no difference].

Hewitt Drawit!