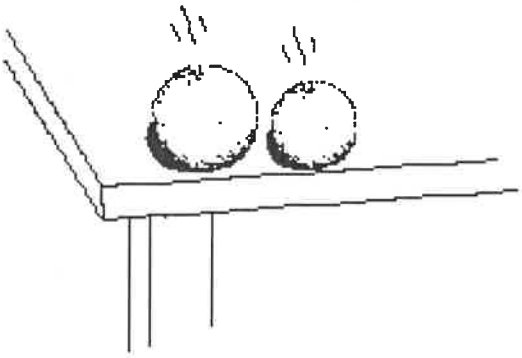
PHYSICS
SPRING BREAK ASSIGNMENT

1. Two oranges accidentally fall out of an upstairs window of a house. One weighs twice as much as the other. The time it takes the **heavier** orange to hit the ground is:
   (A) about half as long as for the lighter orange.
   (B) about twice as long as for the lighter one.
   (C) about the same time for both oranges.
   (D) much less time, but not necessarily half as long.
   (E) much more time, but not necessarily twice as long

IN YOUR NOTEBOOK: PLEASE EXPLAIN 5 OF THE ANSWERS!

2. You roll these same two oranges off a kitchen table with the same speed. The **heavier** orange hits the floor at what horizontal distance from the table's base, compared to the lighter orange?
   (A) about the same distance.
   (B) about half the distance.
   (C) about twice the distance.
   (D) much closer, but not necessarily half the distance.
   (E) much farther, but not necessarily twice as far.

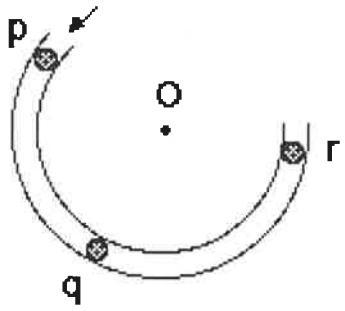


3. You drop an orange, not throw it, from a second story window. Which statement is correct?
   (A) It quickly speeds up, and then falls at a constant speed until it hits the ground.
   (B) It speeds up as it falls, because the force of gravity gets stronger as it gets closer to the ground.
   (C) It speeds up as it falls, because the constant force of gravity pulls it down.
   (D) It falls because that's its natural action; things naturally tend to rest on the Earth's surface.
   (E) It falls because the force of the air pushes it down and the force of gravity pulls it down.

4. A school bus and a small car crash head-on. Which applies a **larger** force on the other?
   (A) The **bus**, because it's heavier.
   (B) The **car**, because it acts like a dead weight to the bus.
   (C) Neither applies *any* force on the other; the car gets smashed up because it's in the way of the bus.
   (D) The bus applies a force on the car, but the car doesn't apply *any* force on the bus.
   (E) They both apply the same strength force on each other; the car gets smashed up because it has less substance.

USE THE STATEMENT AND FIGURE BELOW TO ANSWER THE NEXT TWO QUESTIONS (5 and 6).

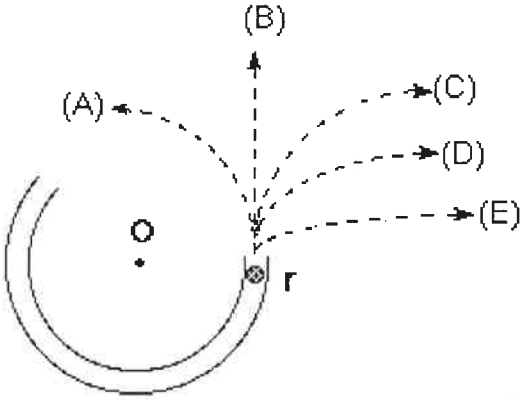
You're looking down at a horizontal game table. A very smooth metal track is fastened to the top of the table so that it can't move, as shown in the figure. (The track is shaped like an incomplete circle, and the center of the circle is marked by a dot: **O**.) You see a marble being shot at high speed into the track at location **p**, and shoot out at location **r**.



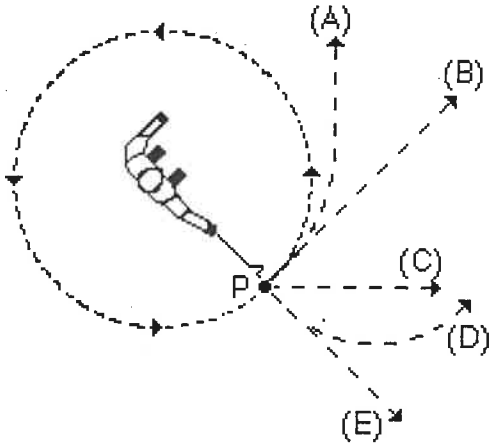
5. When the marble is at location **q** in the track, which of these forces act(s) on it? (Imagine that it's very slippery so there's no friction at all.)
    1. An **inward** force applied by the wall of the track, pointing from **q** to **O**.
    2. A **forward** force in the direction that the marble is moving.
    3. An **outward** force applied by the track, pointing in the direction from **O** to **q**.

    (A) None of these forces.
    (B) 1. (Inward force)
    (C) 2. (Forward force)
    (D) 1 and 2. (Inward & forward forces)
    (E) 2 and 3. (Forward & outward forces)

6. In the figure at the right, which path does the marble take when it shoots out of the track at location **r** and rolls across the table top?

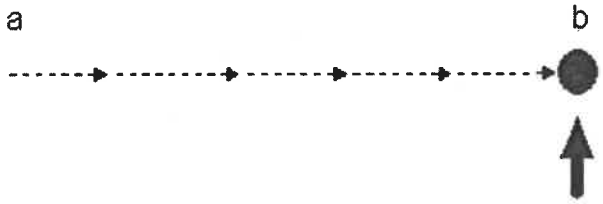


7. You swing a heavy necklace – a medallion that's attached to a string of beads -- in a circular path, horizontal to the ground. At location **P** in the figure, the string breaks near the medallion. Looking down from above, which path does the medallion take after the string breaks?

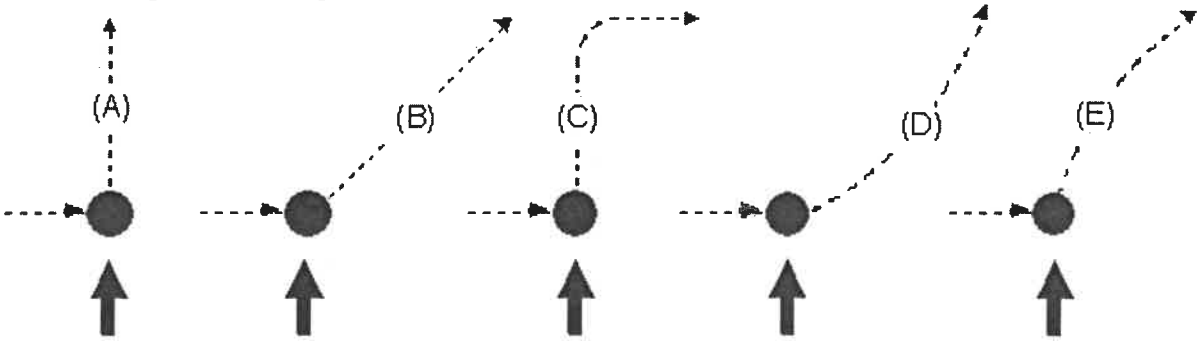


USE THE STATEMENT AND FIGURE BELOW TO ANSWER THE NEXT FOUR QUESTIONS (8 through 11).

A hockey puck slides on very smooth ice in a rink at a constant speed (imagine that's there's no friction) in a straight line from location **a** to location **b**. In the figure, you're looking down at the puck. When the puck reaches **b**, a player **taps** it from the direction of the heavy print arrow.



8. Which path does the puck take after being tapped?

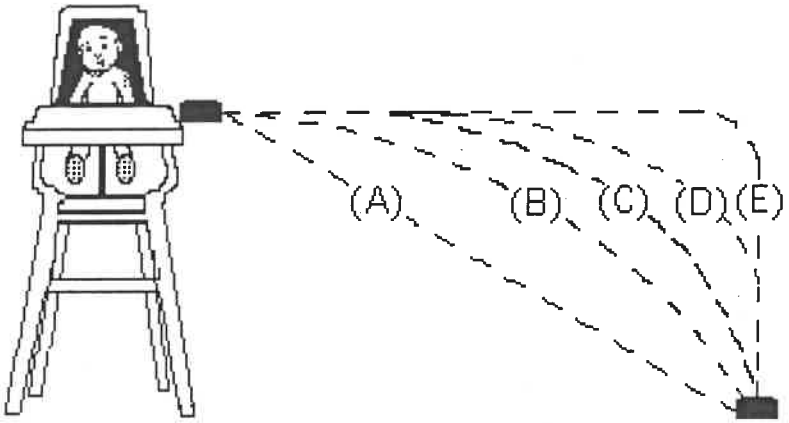


9. In the instant just after the puck is tapped, what is its speed?
   (A) the same speed as before it got tapped.
   (B) the speed given to it by the **tap**; the original speed doesn't matter.
   (C) the sum of its original speed and the speed given to it by the tap.
   (D) smaller than its original speed, and smaller than the speed given to it by the tap.
   (E) greater than its original speed, and greater than the speed given to it by the tap, but less than the sum of these two speeds.

10. Look again at your answer to question 8. While the hockey puck is sliding on the smooth ice (no friction) in the rink after it's tapped, how is its speed changing?
   (A) It isn't changing; the puck moves at a constant speed.
   (B) The puck speeds up.
   (C) The puck slows down.
   (D) The puck speeds up for a while and then slows down.
   (E) The puck moves at a constant speed for a while, and then it slows down.

11. Look again at your answer to question 8. Along the no-friction path that you chose, the force(s) on the puck after it's tapped is (are):
   (A) only a downward force of gravity.
   (B) a force of gravity, and the force of the tap.
   (C) a force of gravity, an upward force by the ice surface, and the force of the tap.
   (D) a force of gravity and an upward force by the ice surface.
   (E) none. No forces act on the puck.

12. A baby in a high chair slides his bowl of food horizontally off the side of his flat tray with a quick push. Which path below best represents the path of the bowl?



13. You throw a softball straight up in the air. What's the main force(s) acting on the ball after it leaves your hand?

(A) A downward force of gravity and an upward force that gets smaller and smaller.

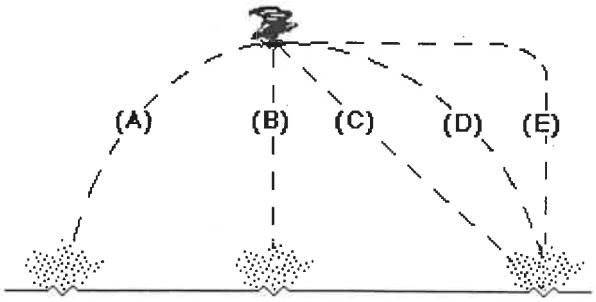
(B) On the way up: an upward force that gets smaller and smaller.
On the way down: a force of gravity.

(C) On the way up: a force of gravity and an upward force that gets smaller and smaller.
On the way down: a force of gravity.

(D) Only a downward force of gravity.

(E) No forces. The ball falls back to ground because that's its natural action.

14. You stand at the lakeshore and watch a bird carry a fish in its claws as it flies across the lake. The bird accidentally drops the fish. Which path do you see the fish take, when it drops?



USE THE STATEMENT AND FIGURE BELOW TO ANSWER THE NEXT TWO QUESTIONS (15 and 16).

A school bus breaks down, and a car pushes it back to the garage.

15. When the car begins to push the school bus, which applies the **larger** force on the other?
    (A) Both apply forces of the same strength on each other.
    (B) The **bus**, because it's heavier.
    (C) The **car**. The bus applies a force, too.
    (D) The **car**. The bus can't apply *any* force to the car, because its engine isn't running.
    (E) Neither applies *any* force on the other. The bus is pushed forward because it's in the car's way.

16. After the car reaches a safe, constant speed for pushing the bus, which applies the **larger** force on the other?
    (A) Both apply forces of the same strength on each other.
    (B) The **bus**, because it's heavier.
    (C) The **car**. The bus applies a force, too.
    (D) The **car**. The bus can't apply *any* force to the car, because its engine isn't running.
    (E) Neither applies *any* force on the other. The bus is pushed forward because it's in the car's way.

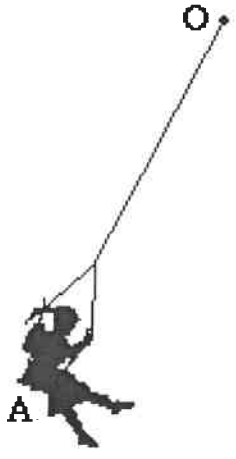
17. While you're slowly lifting a book straight upwards at a constant speed, the upward force of your hand on the book is:
    (A) greater than the downward force of gravity on the book.
    (B) equal to the downward force of gravity on the book.
    (C) smaller than the downward force of gravity on the book.
    (D) equal to the sum of the book's weight *and* the force of gravity on the book.
    (E) the *only* force on the book.

18. The figure at right shows a girl swinging on a swing, starting at a point higher than point A. Consider the following distinct forces:

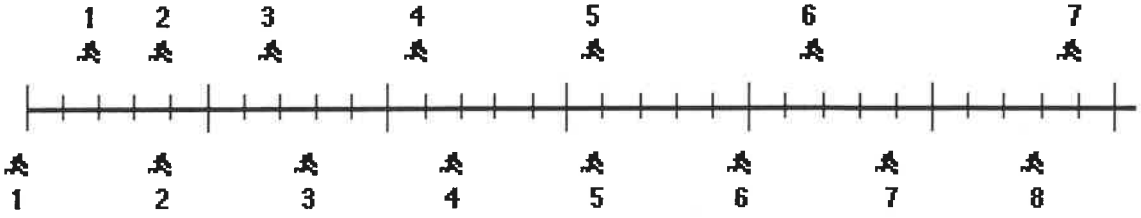
    1. A downward force of gravity.
    2. A force exerted by the rope pointing from A to O.
    3. A force in the direction of the girl's motion.
    4. A force pointing from O to A.

    Which of the above forces act(s) on the girl when she is at position A?

    (A) 1 only.
    (B) 1 and 2.
    (C) 1 and 3.
    (D) 1, 2, and 3.
    (E) 1, 3, and 4.



19. While you and your friend are running, your science teacher takes measurements. Later he makes this drawing. The little stick figures show where both of you are (your positions) at every second of time. You're both running to the right.



Are you and your friend ever running at the same speed?

(A) No.

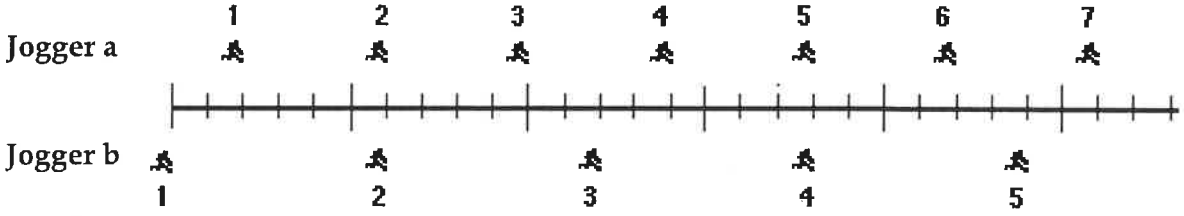
(B) Yes, at the 2nd second of time (that is, at the 2nd stick figures).

(C) Yes, at the 5th second of time (that is, at the 5th stick figures).

(D) Yes, at the 2nd and 5th seconds of time.

(E) Yes, at some time between the 3rd and 4th seconds.

20. The positions of two joggers at each second of time are shown below. They are jogging to the right.



Which jogger is speeding up more quickly? That is, which jogger is accelerating more?

(A) Jogger **a**.

(B) Neither. Both *are* speeding up, and in the same way.

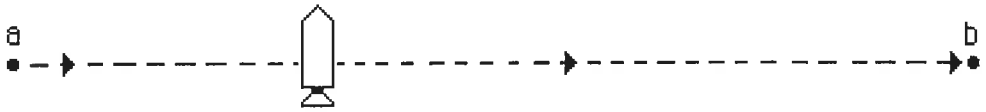
(C) Jogger **b**.

(D) Neither is speeding up; their speeds *aren't* changing.

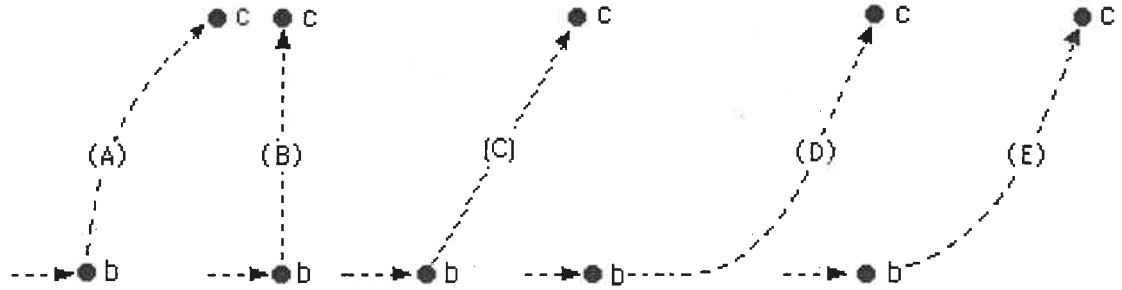
(E) Not enough information to answer the question.

USE THE STATEMENT AND FIGURE BELOW TO ANSWER THE NEXT FOUR QUESTIONS (#21 through 24).

Imagine that you're a space traveler far in the future; you're traveling to another star system. Your spaceship drifts sideways in outer space from location **a** to location **b**. No forces act on the ship during this time. At **b**, the captain turns on the ship's engine, producing a force (called a **thrust**) on the ship at a right angle to the line **ab** (toward the top of this page). The thrust stays constant until the ship reaches some location **c**.

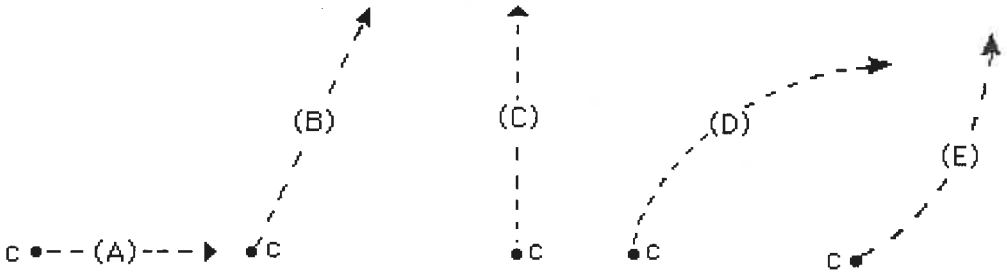


21. Which path below does the spaceship take between locations **b** and **c**?



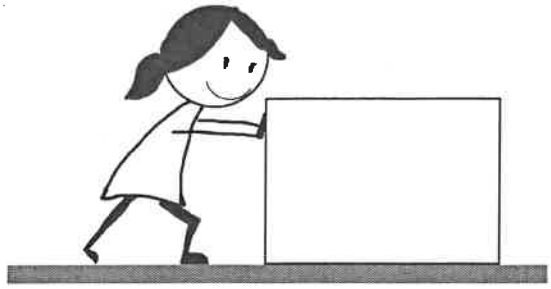
22. As the spaceship moves from location **b** to **c**, its speed:
    (A) is constant.
    (B) is increasing.
    (C) is decreasing.
    (D) increases for a while and then stays constant.
    (E) is constant for a while and then decreases.

23. At location **c** the captain turns off the spaceship's engine, so the thrust from the engine drops to zero. Which path does the ship follow beyond location **c**?



24. Beyond location **c**, the spaceship's speed:
    (A) is constant.
    (B) is increasing.
    (C) is decreasing.
    (D) increases for a while and then stays constant.
    (E) is constant for a while and then decreases.

25. You push a large empty box slowly with a constant horizontal force, so that it moves down your school hallway at a constant speed. The force that you apply is:



(A) the same as the weight of the box.

(B) greater than the weight of the box.

(C) the same as the total friction forces that resist the box's motion.

(D) greater than the total friction forces that resist the box's motion.

(E) the only horizontal force on the box. The friction forces aren't "real".

26. If you now push the box with twice the constant force of question #25, its new speed:

(A) is constant and is twice the speed before.

(B) is constant and is greater than the speed before, but not necessarily twice as fast.

(C) is constant (and greater than before) for a little while; then it increases steadily.

(D) increases for a little while, and then stays constant.

(E) immediately starts increasing steadily.

27. If you suddenly stop touching the box, it will:

(A) stop immediately.

(B) keep moving at the same speed for a little while, and then slow to a stop.

(C) immediately begin slowing to a stop.

(D) continue moving at the same speed.

(E) speed up, and then slow to a stop.

28. Student **a** weighs 160 pounds and student **b** weighs 120 pounds. They sit in identical office chairs facing each other. The chairs have wheels.

Student **a** puts his feet on the knees of student **b** and suddenly pushes outward with his feet, causing both chairs to move.

During the push and while the students are still touching each other, which student applies a **larger** force on the other?

(A) Neither student applies *any* force on the other; they move because they're in each other's way.

(B) **a** applies a force on **b**, but **b** doesn't apply *any* force on **a**.

(C) **b** applies the larger force.

(D) **a** applies the larger force. **b** applies a smaller force.

(E) Each student applies the same strength force on the other, but they react differently.

29. You're scuba diving, and you're resting motionless under water to enjoy the scenery for a while. What upward and downward forces act on you?

(A) Only a downward force of gravity.

(B) A downward force of gravity and an upward force due to the water.

(C) Only a downward force due to the water.

(D) A downward force of gravity and a downward force due to the water.

(E) No forces.

30. You're playing tennis in a strong wind, and you hit a tennis ball so that it goes over the net and lands in your opponent's court. What forces act on the tennis ball while it's in the air (and not touching the racquet)?

(A) Only a downward force of gravity.

(B) A force of gravity and the force of the "hit".

(C) A force of gravity and a force by the air.

(D) The force of the "hit" and a force by the air.

(E) All three forces: a force of gravity, the force of the "hit", and a force by the air.

1. C	6. B	11. D	16. A	21. E	26. E
2. A	7. B	12. B	17. B	22. B	27. C
3. C	8. B	13. D	18. B	23. B	28. E
4. E	9. E	14. D	19. E	24. A	29. B
5. B	10. A	15. A	20. D	25. C	30. C