

## Instructions:

Part II- do on page 4 of scantron mini blue book

## Part I – Scantron

Multiple Choice: Choose the single best response to each question.

1. Tides in the earth's oceans are caused by
  - a. only the earth's gravity
  - b. only the moon's gravity
  - c. only sun's gravity
  - d. both sun and moon's gravity
  - e. both earth and moon's gravity
2. If you double the mass of the earth, the gravitational force of the sun on the earth will be changed to \_\_\_\_\_ times its original value
  - a. 0.25
  - b. 0.50
  - c. 1
  - d. 2
  - e. 4
3. A planet is in orbit around a star. The value for  $g$  of the star at the orbit of the planet is  $5 \text{ m/s}^2$ . The star suddenly collapses to a new diameter that is one half of its original diameter. The mass of the star does not change during the collapse. The value of  $g$  at the planet's orbit after collapse is \_\_\_\_\_  $\text{m/s}^2$ .
  - a. 1.25
  - b. 25.0
  - c. 5.00
  - d. 10.0
  - e. 20.0

You have arrived at a planet that has a radius the same as the earth's radius and a mass that is three times the mass of the earth. Use this information to answer numbers 4 through 6.

- 4,5. Find the value for  $g$ , the acceleration due to gravity on the planet's surface, for this planet in terms of  $g$  on earth. In other words  $g_p = xg_E$ . Find  $x$ .
  - a. 1/9
  - b. 1/3
  - c. 1
  - d. 3
  - e. 9
6. Find the value for  $g$ , the acceleration due to gravity on the planet's surface in  $\text{m/s}^2$ 
  - a. 1.09
  - b. 3.27
  - c. 9.80
  - d. 29.4
  - e. 88.2

The next planet on your trip has a radius 2 times the Earth's radius and a mass the same as the mass of earth. Use this information to answer numbers 7 through 9.

- 7,8. Find the value for  $g$ , the acceleration due to gravity on the planets' surface, for this planet in terms of  $g$  on earth. In other words  $g_p = xg_E$ . Find  $x$ .
  - a.  $\frac{1}{4}$
  - b.  $\frac{1}{2}$
  - c. 1
  - d. 2
  - e. 4
9. Find the weight in newtons of a 5 kg object on the planet's surface.
  - a. 12.3
  - b. 24.5
  - c. 49.0
  - d. 98.0
  - e. 196
10. People in orbit around the earth in the space shuttle appear to be weightless because they
  - a. are above the air
  - b. are far from earth
  - c. are moving rapidly
  - d. are in free fall
  - e. don't feel the gravitational force in orbit

11. Bullet 1 is dropped (by hand) at the same time that bullet 2 is fired horizontally from a rifle. Which bullet lands first? Neglect air resistance.  
 a. 1      b. 2      c. neither, they land at the same time
12. A baseball is thrown horizontally with a speed of 15 m/s. Once the ball has left the thrower's hand, the horizontal acceleration of the ball is \_\_\_\_\_ m/s<sup>2</sup>. neglect air resistance  
 a. 0      b. 5.2      c. 9.8      d. 15.0      e. 24.8
13. A baseball is thrown horizontally with a speed of 15 m/s. Once the ball has left the thrower's hand, the vertical acceleration of the ball is \_\_\_\_\_ m/s<sup>2</sup>. neglect air resistance  
 a. 0      b. 5.2      c. 9.8      d. 15.0      e. 24.8

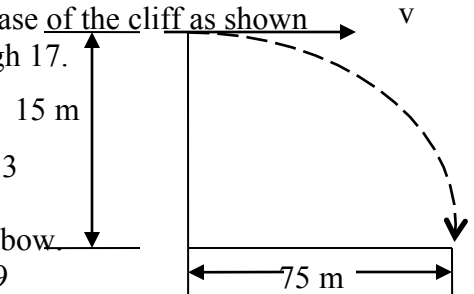
A 0.2 kg arrow is shot horizontally with a speed of  $v$  from a cliff 15 meters above the level ground below the cliff. The arrow lands 75 m from the base of the cliff as shown to the right. Use this information to answer numbers 14 through 17.

14,15. How many seconds is the arrow in the air?

- a. 1.75      b. 2.17      c. 3.06      d. 3.91      e. 15.3

16,17. Find the speed  $v$  in m/s of the arrow when it leaves the bow.

- a. 4.90      b. 19.2      c. 24.5      d. 34.6      e. 42.9



A car is following a curved path from point 1 to point 3 as shown to the right. Use this information to answer numbers 18 through 23.

18. The car's speed is increasing at point 1. Which arrow shows the direction of the car's velocity vector?

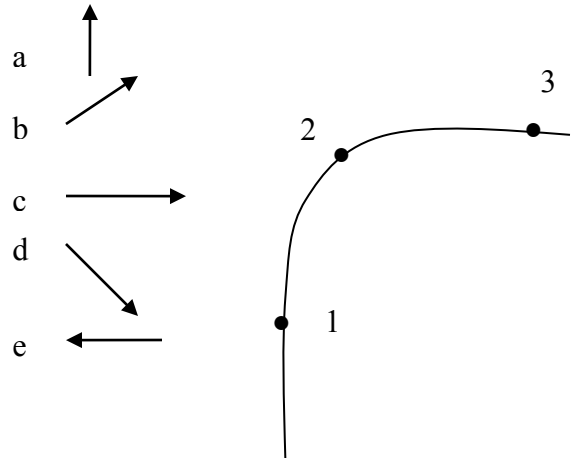
19. The car's speed is constant at point 2. Which arrow shows the direction of the car's velocity vector?

20. The car's speed is decreasing at point 3. Which arrow shows the direction of the car's velocity vector?

21. The car's speed is increasing at point 1. Which arrow shows the direction of the car's acceleration vector?

22. The car's speed is constant at point 2. Which arrow shows the direction of the car's acceleration vector?

23. The car's speed is decreasing at point 3. Which arrow shows the direction of the car's acceleration vector?



24. The centripetal force causes an object's \_\_\_\_\_ to change.  
a. direction of travel    b. speed of travel    c. nothing
- 25,26. If your car goes around a turn with a speed  $v_1$ , it takes a centripetal force  $F_1$  to keep the car going around the turn. What force  $F_2$  is required if you go around the curve with a speed  $v_2$  that is 1.5 times  $v_1$ ?  
a.  $F_1$                     b.  $1.50 F_1$             c.  $2.25 F_1$             d.  $3.00 F_1$             e.  $4.00 F_1$

A 0.3 kg rock is being whirled at the end of a string in a circle of radius 2.0 m. the rock makes 4 revolutions every second. Use this information to answer numbers 27 through 30.

- 27,28. Find the speed of the rock in m/s.  
a. 2.00                    b. 3.14                    c. 6.28                    d. 12.6                    e. 50.3
29. Find the centripetal acceleration of the rock in  $\text{m/s}^2$ .  
a. 2.00    b. 4.93                    c. 19.7                    d. 79.4                    e. 1,260
30. Find the centripetal force in N on the rock  
a. 0.600                    b. 1.48                    c. 5.91                    d. 23.8                    e. 378
31. The net force on a skydiver is greatest when she  
a. first steps out of the airplane  
b. has reached terminal velocity  
c. is halfway between a. and b.
32. The acceleration of a skydiver is least when she  
a. first steps out of the airplane  
b. has reached terminal velocity  
c. is halfway between a. and b.

Use the following information to work problems 33 through 38. A man is measuring the acceleration of an express elevator in the Empire State Building by reading his old bathroom scale that he is standing on while riding the elevator. Before the elevator starts moving, the scale reads 185 lb.

- 33,34,35. While starting to move, the scale reads 165 lb. find the magnitude acceleration of the elevator in  $\text{ft/s}^2$ .  
a. 0.289    b. 3.46                    c. 5.78                    d. 28.5                    e. 32.0
36. What is the direction of the acceleration?  
a. up.    b. down                    c. there is no way to tell
- 37,38. Later the elevator is traveling at a constant speed of 15 ft/s. Find the reading on the scale in pounds.  
a. 165    b. 170                    c. 185                    d. 200                    e. 205

39,40,41. How many feet in altitude would a skydiver have to be in order to be able to fall through the air for 25 seconds? Neglect air resistance.

- a. 123      b. 400      c. 800      d. 37,062      e. 10,000

42. Which of the following statements is correct?

- a. 1 kg isn't related to 2.2 lb      d. 1 kg equals 2.2 lb  
b. 1kg has a mass of 2.2 lb      e. none of these  
c. 1 kg weighs 2.2 lb

Identify the following as either: free fall (mark a) or not free fall (mark b)

43. A feather dropped from two meters above the earth

44. A rock dropped from two meters above the earth

45. A satellite in orbit around the earth

46. The space shuttle during re-entry through the earth's atmosphere

### Part 2

1. An object weighs 15 N when on the surface of the earth. It is then moved to a distance 3.5 times the earth's radius, (measured from the center of the earth). Find: the weight of the object at this distance.

Ans: 1.22 N

2. The mass of Venus is  $4.90 \times 10^{24}$  kg and its distance from the sun is  $1.08 \times 10^{11}$  m. It takes  $1.94 \times 10^7$  s to complete an orbit.

Find: the gravitational force exerted on Venus by the Sun.

Ans:  $5.54 \times 10^{22}$  N

3. Reproduce the following drawing on page 4 of your scantron mini blue book and indicate the vectors for the following at points 1 and 2 on the projectile path provided.

- a. acceleration      b. vertical velocity component  
c. horizontal velocity component

