AP1 Exam 4 2014 Chapters 2-8 Multiple Guess Section

1. A newly discovered planet, *Rosmarinus*, has two times Earth mass, but the acceleration due to gravity on the surface of *Rosmarinus* is exactly the same as the acceleration due to gravity at Greenwich, CT. The radius of *Rosmarinus* in terms of the radius ***R*** of Earth is

A. $\frac{1}{2}R$ B. $\frac{\sqrt{2}}{2}R$ C. $\sqrt{2}R$ D. $2R$ E. $4R$

2. Mars, the Red Planet, Roman God of War, Home to John Carter & his beloved Princess Dejah Thoris, happens to have $^1/_{10}$ the mass of Earth and $^1/_2$ the diameter of Earth. The acceleration of a falling Martian Freshman near the surface of Mars is almost exactly real close to approximately

A. 0.25 m/s^2 B. 0.5 m/s^2 C. 2 m/s^2 D. 4 m/s^2 E. 25 m/s^2

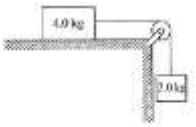
3. A bowling ball weighing 60 Newtons swings as a pendulum as done in class several times; it's the one perched precariously above the Cabbage Patch Dolls on the Demo Desk. At the bottom of the swing, the tension in the string is 90 Newtons. What is the magnitude of the centripetal acceleration of the ball at the bottom of the swing?

A. Zero B. $\frac{1}{2}g$ C. g D. $\frac{3}{2}g$ E. $\frac{5}{2}g$

4. A NASA rocket lifts a huge new satellite from the surface of Earth; like DUH, like they work from other planets? The radius of Earth is ***R*** and the weight of the satellite *on the surface* of Earth is ***mg***. The force of Earth's gravity on the satellite is $\frac{mg}{2}$ when the distance to the rocket from the center of Earth is

A. R B. $\sqrt{2}R$ C. $2R$ D. $2\sqrt{2}R$ E. $4R$

8. The modified Atwood Machine shown below is released from rest. If friction and monsters are ignored, the acceleration of the block on the tabletop is nearly



A. Zero B. 1.7 m/s^2 C. 3.3 m/s^2 D. 5 m/s^2 E. 10 m/s^2

10. A very angry semi-portly grey-haired retired Fizzix teacher is standing in front of the room twirling a toxic lead ball around his head in a horizontal circle. The ball is moving at a constant speed in a circle of radius R and completes one revolution in time T. Which expression below indicates the acceleration of the ball while circling Taylor's big head?

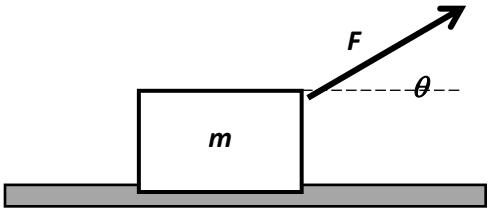
(A) Zero (B) $\frac{4\pi^2 R}{T^2}$ (C) $\frac{\pi R}{T^2}$ (D) g (E) $2\pi g$

17. If F_E is the magnitude of the force of gravity exerted by Earth on the Iridium satellite at radius ***R*** mentioned in the previous question, and F_S is the magnitude of the force exerted by the satellite on the Earth, what is the relationship between F_E and F_S?

(A) F_E is much larger than F_S (B) Both F_E and F_S are zero

(C) F_E is non-zero and equal to F_S (D) F_E is zero and F_S is small, but non-zero

Use the following information for Questions #19 & 20: Consider a mass ***m*** being pulled across a rough floor at constant velocity by a rope providing a force ***F*** that makes an angle of θ to the horizontal. The coefficient of kinetic friction is μ.



19. What is the normal force exerted by the surface on the block?

(A) (B) (C) (D)

20. What is the magnitude of the frictional force?

(A) (B) (C) (D)

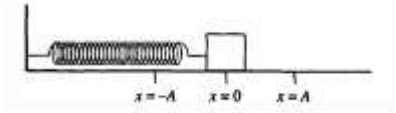
21. How much work is done on the block by F if it moves 10 m?

(A) (B) (C) (D)

1. As demonstrated in class *just now* (ask if you need another shot or feel free to play with it yourself), if a mass ***m*** is attached to a horizontal spring (even though I showed it vertically to avoid that nasty friction thing) with a spring constant ***k*** and it is set into periodic motion by me pulling down on the mass a displacement ***d*** from its equilibrium position, what would be the speed ***v*** of the mass when it returns to the equilibrium position?

(A) $v = \sqrt{\frac{kd}{m}}$ (B) $v = \sqrt{\frac{kd}{mg}}$ (C) $v^2 = \frac{mgd}{k}$ (D) $v = d\sqrt{\frac{k}{m}}$

Use the following info for Questions #2 & 3. A box of unused Fizzix text books sits on a horizontal *frictionless* table and is attached to an ideal spring. The block then oscillates back and forth between ***X*** and ***Z*** with ***Y*** the midpoint.

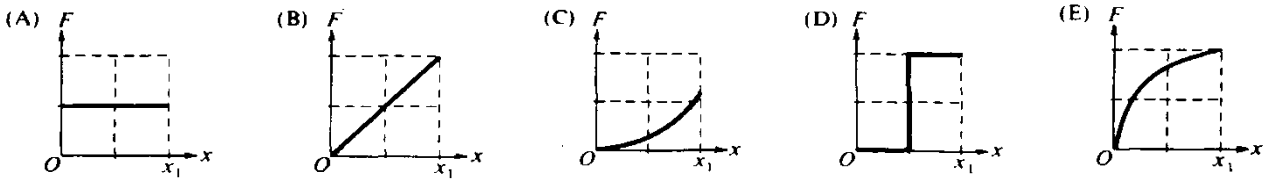


X ***Y*** ***Z***

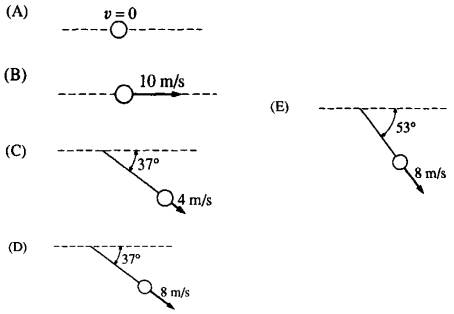
2. Which statement below is correct about the box-o-books?
   (A) At ***Y***, its velocity is zero. maximum.
   (C) At ***Z***, its displacement is at a maximum. (D) At ***Z***, its velocity is at a maximum.
   (E) At ***Z***, its acceleration is zero.
3. Which statement below is correct about the energy of the *box-o-books* & *spring system*?
   (A) The potential energy of the spring is at a minimum at ***Y***. (B) The potential energy of the spring is at a minimum at ***Z***.
   (C) The kinetic energy of the box is at a minimum at ***Y***. (D) The kinetic energy of the box is at a maximum at ***Z***.
   (E) The kinetic energy of the box is always equal to the potential energy of the spring.
6. An NCAA Div I softball player catches a ball of mass ***m*** which is moving towards her with horizontal speed ***v***. While catching the ball, her hand/glove moved back a distance ***d***. Assuming constant acceleration, the horizontal force exerted on the ball by her is

   (A) $\frac{mv^2}{2d}$ (B) $\frac{mv^2}{d}$ (C) mvd (D) $\frac{2mv}{d}$

13. An object is confined to move along a straight horizontal line; maybe an x-axis or such. Each of the graphs shown, drawn to the same scale, represents the force ***F*** acting on the object as a function of the position ***x*** of the object. Which graph represents the force that will cause the greatest change in the kinetic energy of the object from ***x = 0*** to ***x = x_1***?



17. A mass ***m*** has speed ***v***. It then collides with a stationary object of mass 2***m***. If both objects stick together in a *perfectly inelastic* collision, what is the final speed of the newly formed object?
   (A) ***v*** / 3 (B) ***v*** / 2 (C) 2***v*** / 3 (D) ***v*** (E) 3***v*** / 2
24. An empty railroad car of mass ***m*** is moving at speed ***v*** when it collides with a second fully loaded railroad car of mass ***M*** which is at rest. They lock together and move along the rail track at the same speed. What is that speed?
   (A) ***v***/2 (B) ***mv***/***M*** (C) ***Mv***/***m*** (D) (***m*** + ***M***)***v***/***m*** (E) ***mv***/(***m***+***M***)
27. You are engaged in the Greenwich International Billiard Championships. You face off with Pennsylvania Fats, a 67-time Grand Master Champion pool player and semi-retired high school Fizzix teacher. You can win with the next shot. Your cue ball hits one ball, Ball ***X***, and Ball ***X*** moves off with a speed of 10 m/s as shown in Fig I below right. Ball ***X*** then collides with the 8-ball, Ball ***Y***, of equal mass, but stationary. After the collision, ball ***X*** moves at 6 m/s at 53° to its original direction, also as shown below right. Which of the provided diagrams best represents the motion of ball ***Y*** after the collision?



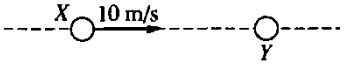


Figure I

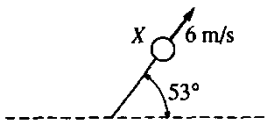


Figure II