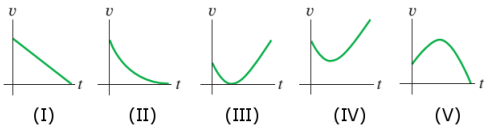
		Surname		Type
Group Number		Name		A
List Number		e-mail		
Student ID		Signature		

ATTENTION:Each question has only one correct answer and is worth one point. Be sure to fill in completely the circle that corresponds to your answer on the answer sheet. Use a pencil (not a pen). Only the answers on your answer sheet will be taken into account.

1. A simple pendulum (a mass swinging at the end of a string) starts swinging from right to left. What is the direction of the acceleration of the mass when it is at the left end of the swing?

(a) to the left (b) centrifugal (c) to the rotation axis (d) the tangential to the path (e) zero

2. A stone is thrown into the air at an angle above the horizontal and feels negligible air resistance. Which graph in the figure best depicts the stone's speed as a function of time t while it is in the air?



(a) II (b) III (c) V (d) IV (e) I

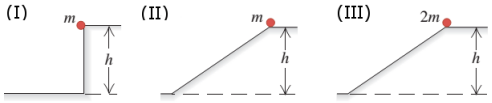
3. In uniform circular motion, how does the acceleration change when the speed is increased by a factor of 3 and the radius is decreased by factor 2?

(a) 18 (b) 36 (c) 1/18 (d) 9 (e) 1/36

4. An elevator is hoisted by its cables at constant speed. What is the total work done by cables and gravity on the elevator?

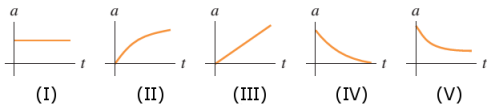
(a) Positive (b) Zero (c) Depends on number of cables (d) Negative (e) Undeterminable

5. Which statement is true for the masses sliding down from the various inclines shown in figure? There is no friction or air resistance!



(a) I will have the largest speed.
(b) They all have different speeds. (c) III will have the largest speed.
(d) They all have the same speed.
(e) I and II will have the same speed and it is going to be different from III.

6. A ball is dropped from rest and feels air resistance as it falls. Which of the graphs in figure best represents its acceleration as a function of time?

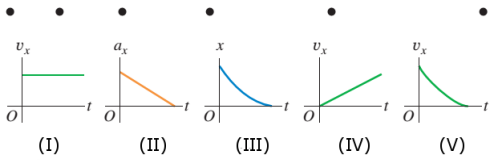


(a) V (b) IV (c) III (d) II (e) I

7. Which of the following statements is correct?
(1) The work done by any force might be positive or negative depending on the choice of the frame of reference.
(2) Any friction force will decrease the speed of the body in any reference frame.
(3) No friction force can do a positive work in any reference frame.

(a) 2,3 (b) 3 (c) 1 (d) None of them (e) 2

8. The top diagram in figure represents a series of highspeed photographs of an insect flying in a straight line from left to right (in the positive x-direction). Which of the graphs in figure most plausibly depicts this insect's motion?



(a) V (b) I (c) III (d) II (e) IV

Questions 9-11

$\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = a\hat{i} - \hat{j} - 2\hat{k}$ vectors are given.

9. What should be the value of a to make $\vec{B}$ perpendicular to $\vec{A}$?

(a) 0 (b) 1/2 (c) -1 (d) 2 (e) 1

10. What is the unit vector in the direction of $\vec{A}$?

(a) $\frac{2\hat{i}+3\hat{j}-\hat{k}}{\sqrt{14}}$ (b) $\frac{2\hat{i}+3\hat{j}+\hat{k}}{\sqrt{12}}$ (c) $\frac{2\hat{i}-3\hat{j}-\hat{k}}{\sqrt{12}}$ (d) $\frac{-2\hat{i}+3\hat{j}-\hat{k}}{\sqrt{14}}$ (e) $\hat{i}+\hat{j}+\hat{k}$

11. What is the magnitude of the projection of $\vec{B}$ vector on $\vec{A}$ vector if a=1?

(a) $1/\sqrt{12}$ (b) $1/\sqrt{14}$ (c) $\sqrt{12}$ (d) $\sqrt{14}$ (e) $1/\sqrt{84}$

Questions 12-16

A balloon having 20 m/s constant velocity is rising up from ground vertically. When the balloon reaches 160 m height, an object is thrown horizontally with a velocity of 20 m/s with respect to balloon. Assume the mass of the object is small compared to the mass of the balloon. Take $g = 10\ m/s^2$.

12. What is the horizontal distance travelled by the object before it hits the ground.

(a) 80 m (b) 160 m (c) 40 m (d) 200 m (e) 240 m

13. What are the velocity components $(|V_x|, |V_y|)$ of the object when it hits the ground?

(a) (60 $\frac{m}{s}$,20 $\frac{m}{s}$) (b) (20 $\frac{m}{s}$,30 $\frac{m}{s}$) (c) (20 $\frac{m}{s}$,40 $\frac{m}{s}$) (d) (20 $\frac{m}{s}$,20 $\frac{m}{s}$) (e) (20 $\frac{m}{s}$,60 $\frac{m}{s}$)

14. How high is the balloon when the object hits the ground?

(a) 320 m (b) 220 m (c) 280 m (d) 260 m (e) 240 m

15. What is the maximum height of the object with respect to ground?

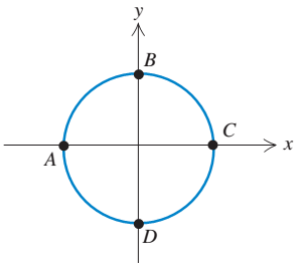
(a) 160 m (b) 180 m (c) 320 m (d) 240 m (e) 90 m

16. Find such a time that the displacement of the object and the balloon are the same after ejecting the object.

(a) 14 s (b) 16 s (c) 10 s (d) 4 s (e) 12 s

Questions 17-19

An athlete starts at point A and runs at a constant speed of 6.0 m/s around a circular track 200 m in diameter clockwise, as shown in figure. Take $\pi = 3$.



17. What is the average velocity of the runner for a complete turn (a lap) ?

(a) 0 $\frac{m}{s}$ (b) 6 $\frac{m}{s}$ (c) 4 $\frac{m}{s}$ (d) 5 $\frac{m}{s}$ (e) 200/6 $\frac{m}{s}$

18. What are the x and y components of the runner's average velocity between A and B ?

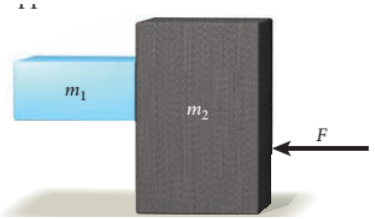
(a) (6 $\frac{m}{s}$, -4 $\frac{m}{s}$) (b) (6 $\frac{m}{s}$, 6 $\frac{m}{s}$) (c) (8 $\frac{m}{s}$, -8 $\frac{m}{s}$) (d) (-4 $\frac{m}{s}$, 6 $\frac{m}{s}$) (e) (4 $\frac{m}{s}$, 4 $\frac{m}{s}$)

19. What are the x and y components of the runner's average acceleration $(a_x, a_y)_{av}$ between A and B ?

(a) (12 $\frac{m}{s^2}$,4 $\frac{m}{s^2}$) (b) (4 $\frac{m}{s^2}$,4 $\frac{m}{s^2}$) (c) ($\frac{6}{25}$ $\frac{m}{s^2}$,$\frac{-6}{25}$ $\frac{m}{s^2}$) (d) (6 $\frac{m}{s^2}$,-4 $\frac{m}{s^2}$) (e) (-6 $\frac{m}{s^2}$,4 $\frac{m}{s^2}$)

Questions 20-23

A block of mass m_1=2.00 kg is placed in front of a block of mass m_2=7.00 kg as shown in the figure. An F=360 N force is applied to the large object as seen in the figure. The coefficient of static friction between the blocks is 0.5 and there is no friction between the larger block and the tabletop. Take $g = 10\ m/s^2$.



20. What is the magnitude of the acceleration of the smaller block?

(a) 30 m/s^2 (b) 15 m/s^2 (c) 20 m/s^2 (d) 40 m/s^2 (e) 10 m/s^2

21. What is the magnitude of the normal force between the two blocks?

(a) 40 N (b) 70 N (c) 60 N (d) 80 N (e) 30 N

22. What is the magnitude of the friction force between the two blocks?

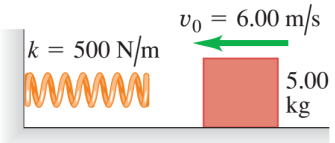
(a) 20 N (b) 25 N (c) 40 N (d) 35 N (e) 15 N

23. What is the magnitude of the normal force exerted by the table to the larger block?

(a) 10 N (b) 70 N (c) 180 N (d) 15 N (e) 90 N

Questions 24-25

A 5 kg block is moving at V_0 = 6.00 m/s along a frictionless, horizontal surface toward a spring with force constant k=500 N/m that is attached to a wall. The spring has negligible mass.



24. What is the maximum distance the spring will be compressed?

(a) 5 m (b) 1 m (c) $\frac{5}{3}$ m (d) $\frac{3}{5}$ m (e) 2 m

25. What is the speed of the block when it leaves the spring?

(a) $\sqrt{12.00}$ $\frac{m}{s}$ (b) $\sqrt{6.00}$ $\frac{m}{s}$ (c) 3.00 $\frac{m}{s}$ (d) 12.0 $\frac{m}{s}$ (e) 6.00 $\frac{m}{s}$