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

ATTENTION: There is normally only one correct answer for each question and each correct answer is equal to 1 point. Only the answers on your answer sheet form will be evaluated. Please be sure that you have marked all of your answers on the answer sheet form by using a pencil (*not* pen).

1. Which force is responsible for holding a car in the track, in an unbanked curve?
(a) The car's weight
(b) The car's engine force
(c) The kinetic friction force
(d) The static friction force
(e) The normal force

2. Which statement is always true for an object having constant $|\vec{v}|$?
(a) $a_{\text{rad}} = 0$ (b) $|a_{\text{tan}}| \geq |a_{\text{rad}}|$ (c) $|a_{\text{tan}}| > |a_{\text{rad}}|$ (d) $|\vec{a}| = 0$ (e) $a_{\text{tan}} = 0$

3. Bodies A and B are thrown from the same position with the same initial speeds at angles α_{A} and α_{B}. Both bodies hit to the same point on the ground. Which of the following is always correct?
(a) $\alpha_{\text{A}} + \alpha_{\text{B}} = \pi/2$
(b) $\alpha_{\text{A}} + \alpha_{\text{B}} = \pi$
(c) $\alpha_{\text{A}} - \alpha_{\text{B}} = \pi/2$
(d) $\sqrt{\alpha_{\text{A}}^2 + \alpha_{\text{B}}^2} = \pi/2$
(e) $\alpha_{\text{A}} + \alpha_{\text{B}} = \pi/4$

4. If the weight of an object of mass 10 kg is 50 N, then what is the maximum range of the object thrown with an initial speed of 50 m/s? (Assume that there is no air resistance.)

(a) 5 m (b) 500 m (c) 250 m (d) 10 m (e) 1000 m

Questions 5-6

One of the forces acting on a particle with a mass of 1 kg is given as $\vec{F}(t) = 3t\,\hat{\imath} - 2\,\hat{\jmath}$ [Newton] and its position is given as $\vec{r}(t) = t/2\,\hat{\imath} - t^3\,\hat{\jmath}$ [meter]

5. What is the average velocity in m/s between $t = 1$ and $t = 3$ sec?
(a) $1/2\,\hat{\imath} - 3\,\hat{\jmath}$ (b) $2\,\hat{\imath} - 12\,\hat{\jmath}$ (c) $2\,\hat{\imath} + 14\,\hat{\jmath}$ (d) $1/2\,\hat{\imath} - 14\,\hat{\jmath}$ (e) $1/2\,\hat{\imath} - 13\,\hat{\jmath}$

6. What is the instantaneous power acting on this particle by the forces other than $\vec{F}$ at $t = 2$ sec?
(a) -123 W (b) 117 W (c) -120 W (d) 123 W (e) 67 W

Questions 7-9

The velocity of a particle moving in a straight line is given as $v(t) = (-t^2/2 + 3t + 3/2)$ where t is in seconds and v is in m/s.

7. Calculate the particle's acceleration at $t = 2$ s.
(a) 3 m/s^2 (b) 5 m/s^2 (c) 11/2 m/s^2 (d) 1 m/s^2 (e) 4 m/s^2

8. Compute the time when the force acting on the particle changes its direction.
(a) 19/2 s (b) 3/2 s (c) 0 s (d) 1 s (e) 3 s

9. Calculate the position r of the particle when the force acting on the particle changes its direction. Take $r(t = 0) = 0$.
(a) 27/2 m (b) 0 (c) 23/3 m (d) 17/6 m (e) 27/5 m

Questions 10-14

Position vector of an object A with mass m_A relative to the Earth (E) is given as $\vec{r}_{A/E} = (3t^2 + 104)\hat{\imath} + 2t\hat{\jmath} + \hat{k}$, that of object B with mass m_B = relative to the object A is given as $\vec{r}_{B/A} = (-t^2 + 2t - 100)\hat{\imath} + (-2t + 5)\hat{\jmath} - \hat{k}$. ($m_A = 10$ kg, $m_B = 5$ kg)

10. Find the position vector of B relative to the Earth, $\vec{r}_{B/E}$.
(a) $(4t^2 - 2t + 204)\hat{\imath} + (4t - 5)\hat{\jmath} + 2\hat{k}$
(b) $(-2t^2 - 2t - 4)\hat{\imath} - 5\hat{\jmath}$
(c) $(2t^2 + 2t + 4)\hat{\imath} + 5\hat{\jmath} + 2\hat{k}$
(d) $(-4t^2 + 2t - 204)\hat{\imath} + (-4t + 5)\hat{\jmath} + 2\hat{k}$
(e) $(2t^2 + 2t + 4)\hat{\imath} + 5\hat{\jmath}$

11. Find the velocity of B relative to the Earth, $\vec{v}_{B/E}$.
(a) $(8t - 2)\hat{\imath} + 4\hat{\jmath}$ (b) $(-4t - 2)\hat{\jmath}$ (c) $(4t + 2)\hat{\imath}$ (d) $(-8t + 2)\hat{\imath} - 4\hat{\jmath}$ (e) $(-4t - 2)\hat{\imath}$

12. Find the magnitude of the total external force exerted on B.
(a) 20 N (b) $(20t + 10)$ N (c) 40 N (d) 0 N (e) -20 N

13. Find the speed of A relative to B at $t = 0$.
(a) 2 m/s (b) $2\sqrt{2}$ m/s (c) 4 m/s (d) $2\sqrt{5}$ m/s (e) 0 m/s

14. When do A and B meet each other? (Assume they are point particles)
(a) $t = \sqrt{11}$ s (b) $t = 101$ s (c) $t = 5/2$ s (d) Never (e) $t = 5/4$ s

Questions 15-17

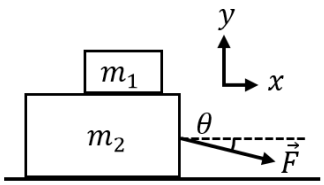
A luggage handler pulls a 20 kg suitcase up a ramp inclined θ above the horizontal by a force of magnitude 210 N, parallel to the ramp. The coefficient of kinetic friction between the ramp and the incline is $\mu_k = 3/8$.
($\sin(\theta) = 3/5$, $\cos(\theta) = 4/5$, $g = 10$ m/s^2)
If the suitcase takes 3 m distance along the ramp;

15. Calculate the work done on the suitcase by the gravitational force
(a) -180 J (b) 0 (c) 360 J (d) -360 J (e) -135 J

16. Calculate the total work done on the suitcase.
(a) 90 J (b) 480 J (c) 0 (d) 360 J (e) 300 J

17. If the speed of the suitcase is zero at the bottom of the ramp, what is the speed when it takes 3m along the ramp?
(a) $4\sqrt{2}$ m/s (b) 3 m/s (c) 0 (d) $2\sqrt{6}$ m/s (e) $\sqrt{6}$ m/s

Questions 18-20



A block of mass m_1 rests on top of another block of mass m_2, which rests on a frictionless horizontal surface. The coefficient of static and kinetic friction between the two blocks are $\mu_s = 1/2$ and $\mu_k = 1/4$, respectively. A force F is applied to m_2 as shown in figure. ($m_1 = 1$ kg, $m_2 = 2$ kg, $\sin(\theta) = 4/5$, $\cos(\theta) = 3/5$, $\vec{g} = -10$ m/s^2 $\hat{\jmath}$)

18. Which magnitude of $\vec{F}$ below ensures that the blocks accelerate together without m_1 sliding on m_2?
(a) 32 N (b) 29 N (c) 22 N (d) 26 N (e) 34 N

19. Find the acceleration of each block for $F = 15$ N.
(a) 7/2 m/s^2 (b) 5 m/s^2 (c) 3 m/s^2 (d) 2 m/s^2 (e) 9/2 m/s^2

20. Find the acceleration of each block for $F = 35$ N, where a_1 is the aceleration of m_1 and a_2 is the aceleration of m_2, relative to the horizontal surface.
(a) $a_1 = 5$ m/s^2, $a_2 = 8$ m/s^2
(b) $a_1 = 5/2$ m/s^2, $a_2 = 21$ m/s^2
(c) $a_1 = 5/2$ m/s^2, $a_2 = 37/4$ m/s^2
(d) $a_1 = 2$ m/s^2, $a_2 = 51/4$ m/s^2
(e) $a_1 = 1/2$ m/s^2, $a_2 = 21$ m/s^2