Physics 1 – additional tasks

1. During a short interval of time the speed v in m/s of an automobile is given by $v = at^2 + bt^3$, where the time t is in seconds. The units of a and b are respectively:
   A) $m \cdot s^2$; $m \cdot s^4$ B) s^3/m; s^4/m C) m/s^2; m/s^3 D) m/s^3; m/s^4 E) m/s^4; m/s^5

2. Suppose $A = BC$, where A has the dimensions L/M and C has the dimensions L/T. Then B has the dimension:
   A) T/M B) L^2/TM C) TM/L^2 D) L^2T/M E) M/L^2T

3. Suppose $A = B^nC^m$, where A has dimensions LT, B has dimensions L^2T^{-1}, and C has dimensions LT^2. Then the exponents n and m have the values:
   A) 2/3; 1/3 B) 2; 3 C) 4/5; –1/5 D) 1/5; 3/5 E) 1/2; 1/2

4. Let $\vec{A}$ = (2 m)$\hat{\imath}$ + (6 m) $\hat{\jmath}$ – (3 m) $\hat{k}$ and $\vec{B}$ = (4 m)i4$\hat{\imath}$ + (2 m) $\hat{\jmath}$ + (1 m) $\hat{k}$. The vector sum $\vec{C} = \vec{A} + \vec{B}$ is:

   A) (6 m) $\hat{\imath}$ + (8 m) $\hat{\jmath}$ – (2 m) $\hat{k}$ D) (8 m) $\hat{\imath}$+ (12 m) $\hat{\jmath}$ – (3 m) $\hat{k}$

   B) (–2 m) $\hat{\imath}$ + (4 m) $\hat{\jmath}$ – (4 m) $\hat{k}$ E) none of these

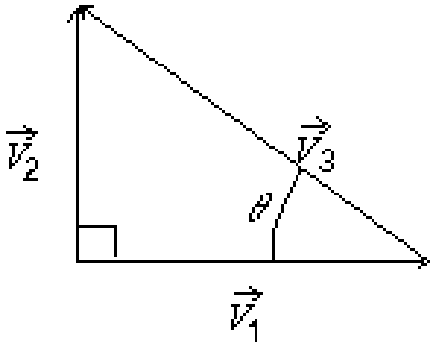
   C) (2 m) $\hat{\imath}$ – (4 m) $\hat{\jmath}$+ (4 m) $\hat{k}$

5. A vector of magnitude 20 is added to a vector of magnitude 25. The magnitude of this sum can be:
A) zero B) 3 C) 12 D) 47 E) 50

6. We say that the displacement of a particle is a vector quantity. Our best justification for this assertion is:
A. displacement can be specified by a magnitude and a direction
B. operating with displacements according to the rules for manipulating vectors leads to results in agreement with experiments
C. a displacement is obviously not a scalar
D. displacement can be specified by three numbers
E. displacement is associated with motion

7. The vector $\overrightarrow{V_3}$in the diagram is equal to:

A) $\vec{V}_1 - \vec{V}_2$ B) $\vec{V}_1 + \vec{V}_2$ C) $\vec{V}_2 - \vec{V}_1$ D) $\vec{V}_1 \cos\theta$ E) $V_1/(\cos\theta)$



8. If $|\vec{A} + \vec{B}|$= A + B and neither $\vec{A}$ nor $\vec{B}$ vanish, then:

A) $\vec{A}$ and $\vec{B}$ are parallel and in the same direction
B) $\vec{A}$ and $\vec{B}$ are parallel and in opposite directions
C) the angle between $\vec{A}$ and $\vec{B}$ is 45^o
D) the angle between $\vec{A}$ and $\vec{B}$ is 60^o

E) $\vec{A}$ is perpendicular to $\vec{B}$

9. Two automobiles are 150 kilometers apart and traveling toward each other. One automobile is moving at 60 km/h and the other is moving at 40 km/h mph. In how many hours will they meet?
A. 2.5 B. 2.0 C. 1.75 D. 1.5 E. 1.25

10. A car starts from Hither, goes 50 km in a straight line to Yon, immediately turns around, and returns to Hither. The time for this round trip is 2 hours. The average speed of the car for this round trip is:
A. 0 B. 50 km/h C. 100 km/h D. 200 km/h
E. cannot be calculated without knowing the acceleration

11. The coordinate of a particle in meters is given by $x(t) = 16t - 3.0t^3$, where the time t is in seconds. The particle is momentarily at rest at t

A. 0.75 s B. 1.3 s C. 5.3 s D. 7.3 s E. 9.3 s

12. A drag racing car starts from rest at t = 0 and moves along a straight line with velocity given by $v = bt^2$, where b is a constant. The expression for the distance traveled by this car from its position at t = 0 is:

A. bt^3 B. $bt^3/3$ C. $4bt^2$ D. $3bt^2$ E. $bt^3/2$

13. A ball rolls up a slope. At the end of three seconds its velocity is 20 cm/s; at the end of eight seconds its velocity is 0. What is the average acceleration from the third to the eighth second?

A. 2.5 cm/s^2 B. 4.0 cm/s^2 C. 5.0 cm/s^2 D. 6.0 cm/s^2 E. 6.67 cm/s^2

14.The coordinate of an object is given as a function of time by $x = 7t - 3t^2$, where x is in meters and t is in seconds. Its average velocity over the interval from t = 0 to t = 4 s is:

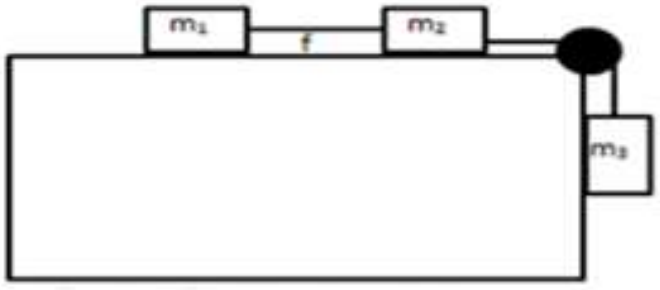
A. 5 m/s B. −5 m/s C. 11 m/s D. −11 m/s E. −14.5 m/s

13 . A 1000-kg elevator is rising and its speed is increasing at 3 m/s^2. The tension in the elevator cable is:
A) 6800 N B) 1000 N C) 3000 N D) 9800 N E) 12800 N

14. Please calculate the system acceleration, if: $m_1 = 2$ kg, $m_2 = 1$ kg, $m_3 = 5$ kg and

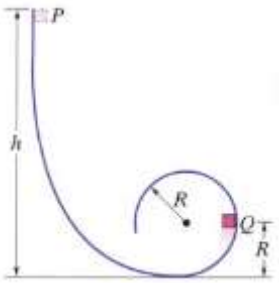
a) there is no friction,

b) friction coefficient (for m_1 and m_2) is 0.2.



15. An object moves in a circle at constant speed. The work done by the centripetal force is zero because:
A) the displacement for each revolution is zero
B) the average force for each revolution is zero
C) there is no friction

D) the magnitude of the acceleration is zero
E) the centripetal force is perpendicular to the velocity



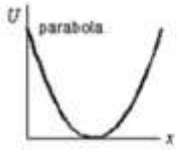
16. At what height h should be a block released from rest at point P so that it is on the verge of losing contact with the track at the top of the loop?

17. Two objects interact with each other and with no other objects. Initially object A has a speed of 5 m/s and object B has a speed of 10 m/s. In the course of their motion they return to their initial positions. Then A has a speed of 4 m/s and B has a speed of 7 m/s. We can conclude:

A) the potential energy changed from the beginning to the end of the trip
B) mechanical energy was increased by nonconservative forces
C) mechanical energy was decreased by nonconservative forces
D) mechanical energy was increased by conservative forces
E) mechanical energy was decreased by conservative forces

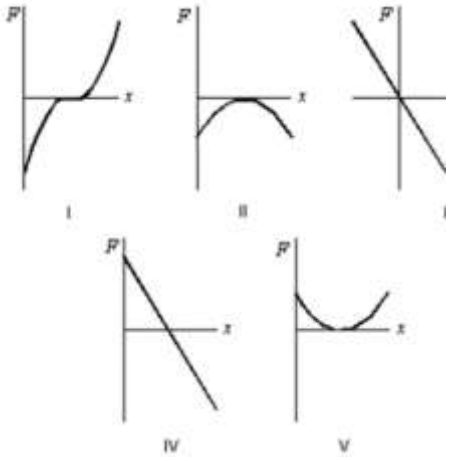
18 The potential energy of a body of mass m is given by $U = –mgx + 1/2kx^2$. The corresponding force is:

A) $–mgx^2/2 + kx^3/6$
B) $mgx^2/2 – kx^3/6$
C) $–mg + kx/2$
D) $–mg + kx$
E) $mg – kx$



19 . The first graph shows the potential energy U(x) for a particle moving on the x axis. Which of the following five graphs correctly gives the force F exerted on the particle?

A) I B) II C) III D) IV E) V



20. A particle moves 5 m in the positive x direction while being acted upon by a constant force

$$\vec{F} = 4\,\hat{\imath} + 2N\hat{\jmath} + 4\hat{k}\,[N]$$

¢ = (4 N)3 + (2 N)z – (4 N)y. The work done on the particle by this force is:

A) 20 J
B) 10 J
C) –20 J
D) 30 J
E) is impossible to calculate without knowing other forces

21. How much work does a supermarket checkout attendant do on a can of soup he pushes 0.600 m horizontally with a force of 5.00 N? Express your answer in joules and kilocalories.

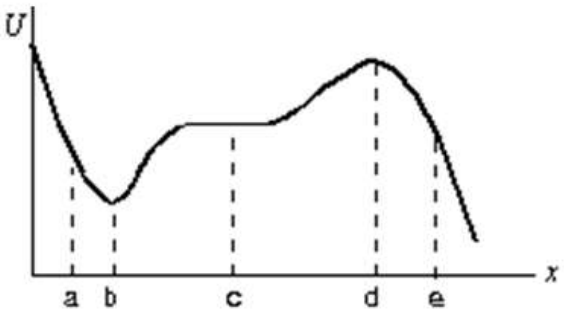
Physics 1 – additional tasks

22. Which of the following five quantities is NOT an expression for energy? Here m is a mass, g is the acceleration due to gravity, h and d are distances, F is a force, v is a speed, a is an acceleration, P is power, and t is time.

A) mgh B) Fd C) 1/2mv2 D) ma E) Pt

23. The diagram shows a plot of the potential energy as a function of x for a particle moving along the x axis.

a) The points of stable equilibrium are:



A) only a B) only b C) only c D) only d E) b and d

b) The points of unstable equilibrium are:

A) only a B) only b C) only c D) only d E) b and d

c) The points of neutral equilibrium are:

A) only a B) only b C) only c D) only d E) b and d

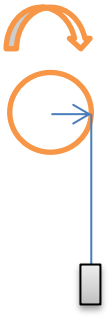
24. When a thin uniform stick of mass M and length L is pivoted about its midpoint, its rotational inertia is $ML^2/12$. When pivoted about a parallel axis through one end, its rotational inertia is:

A. $ML^2/12$
B. $ML^2/6$
C. $ML^2/3$
D. $7ML^2/12$
E. $13ML^2/12$

25. The rotational inertia of a solid uniform sphere about a diameter is (2/5)MR2, where M is its mass and R is its radius. If the sphere is pivoted about an axis that is tangent to its surface, its rotational inertia is:

A. MR2
B. $(2/5)MR^2$
C. $(3/5)MR^2$
D. $(5/2)MR^2$
E. $(7/5)MR^2$

26. A block of mass M and radius r can rotate about a horizontal axis as shown .



A block of mass m is attached to the end of a string wound around the block.

a) Please determine (formula) the acceleration of the block?
b) Please find the angular velocity of the block after time t since the block was released