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Name-Surname :
Number :
Department :
Signature :

FİZ 134 PHYSICS I
2009-2010 FALL SEMESTER
FINAL EXAM
15.01.2010

1. The duration of the exam is 120 minutes.
2. There are 30 questions with equal weight in this exam.
3. This question booklet is type "**M**" booklet. Check to see that all pages are type "**M"**
4. Use the appropriate box in the answer page.
5. Five wrong answers nullify a correct answer.
6. If need be, use the back page of the booklet for calculation.
7. Please fill in identity information both the booklet and answer sheet.
8. It is not allowed to use calculator.

GIVENS:

The acceleration of gravity: $g = 10\ m/s^2$
$\sin 45^\circ = \cos 45^\circ = 0.7$
$\sin 37^\circ = \cos 53^\circ = 0.6$
$\sin 53^\circ = \cos 37^\circ = 0.8$
$\tan 37^\circ = 0.75$
$\sin 30^\circ = \cos 60^\circ = -\cos 120^\circ = 0.5$
$\sin 60^\circ = \cos 30^\circ = 0.87$
$\cos 180^\circ = -1$
$\pi = 3$
$\sqrt{2} = 1.4$
$\sqrt{3} = 1.7$

Metric Prefixes

Number	Prefix	Abbr.
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

$I_{c.m.} = (MR^2)/2$ Solid Disk (or Cylinder) about central axis
$I_{c.m.} = MR^2$ Hoop about central axis
$I_{c.m.} = (2MR^2)/5$ Solid sphere about any diameter
$I_{c.m} = \left(ML^2\right)/12$ Thin rod about axis through center perpendicular to length

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1. A car travels for 30 minutes at 90 km/h, stops for 30 minutes and travels again for 30 minutes at 150 km/h. What is the average speed (in km/h) for the entire trip?

   A) 80 B) 160 C) 120 D) 110 E) 70

2. A stone starts falling freely at t = 0. Find the distance (in m) that it travels from t_1 = 3 s to t_2 = 5 s.

   A) 70 B) 80 C) 40 D) 125 E) 35

3. A body is moving through the origin at t = 0 with velocity $\mathbf{v}_o = -2\mathbf{i}+3\mathbf{j}$ m/s and a constant acceleration $\mathbf{a} = \mathbf{i}-2\mathbf{j}$ m/s^2. If the velocity of the body has only the y component at a later time t_1, what is the position vector of the body (in m) at t_1?

   A) $-\mathbf{i}+\mathbf{j}$ B) $\mathbf{i}-2\mathbf{j}$ C) $-2\mathbf{i}+\mathbf{j}$ D) $-2\mathbf{i}+2\mathbf{j}$ E) $2\mathbf{i}-2\mathbf{j}$

4. A boat is able to move through still water at 20 m/s. It makes a round trip to a town 3 km downstream. If the river flows at 5 m/s, what is the time (in s) required for this round trip?

   A) 120 B) 150 C) 200 D) 300 E) 320

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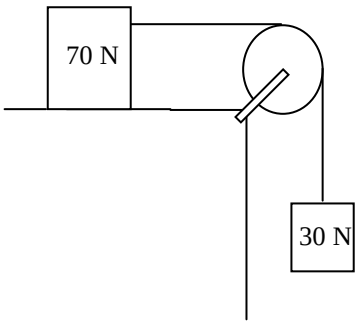
5. 70 N and 30 N blocks are connected as shown by a massless string over a frictionless pulley with negligible mass. If there is no friction between the first block and the surface, what is the magnitude of the acceleration (in m/s^2) of the system?

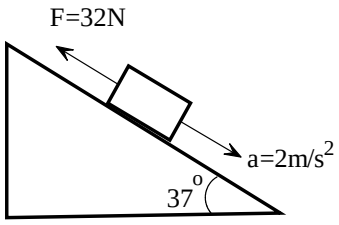


A) 4 B) 3 C) 6 D) 12 E) 5

6. A body of 4 N weight, sliding across a level ice surface, is slowing down with a deceleration of 0.6 m/s^2. What is the coefficient of kinetic friction between the body and ice?

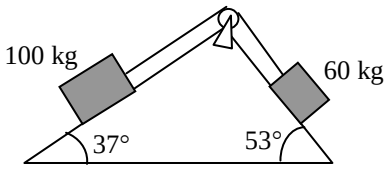
A) 0.41 B) 1.20 C) 9.80 D) 0.06 E) 0.62

7. A 32 N force is applied to a crate on an inclined surface that is 37° above the horizontal, as shown in the figure. The acceleration of the crate is 2 m/s^2 and downward. If the coefficient of kinetic friction between the crate and the incline surface is 0.1, what is the mass (in kg) of the crate?



A) 30 B) 25 C) 20 D) 15 E) 10

8. Two blocks, connected by a massless cord passing over a frictionless pulley with negligible mass, rest on frictionless planes, as shown in the figure. What is the acceleration (in m/s^2) of the blocks?



A) 3/4 B) 4/5 C) 5/3 D) 3/5 E) 4/3

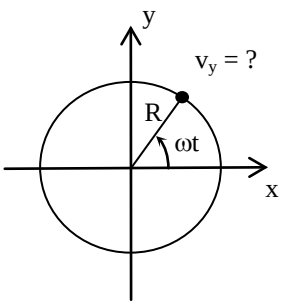
9. A body with mass 10 kg moves from the origin to the position $\mathbf{r} = 4\mathbf{i}+10\mathbf{j}-4\mathbf{k}$ m, while being acted upon by two constant forces $\mathbf{F}_1 = 4\mathbf{i}+2\mathbf{j}-4\mathbf{k}$ N and $\mathbf{F}_2 = -2\mathbf{i}+3\mathbf{j}+2\mathbf{k}$ N. What is the work (in J) done on the particle by these forces?

A) 50 B) 66 C) 64 D) –66 E) –50

10. In a one-dimensional motion, the force is given by $F(x) = 2x-x^2$, where x is in meters and F is in Newtons. A particle travels from x = 0 to x = 2 m, due to the given force acting on it. What is the work done (in J) on the particle?

A) 1/3 B) 2/3 C) 1/2 D) 4/3 E) 5/2

11. A particle moving in a circle of radius 3.0 m with an angular speed of 20.0 rad/s. If the particle starts on the positive x axis at t = 0, what is the y component of its velocity (in m/s) at t = 1.85 s?



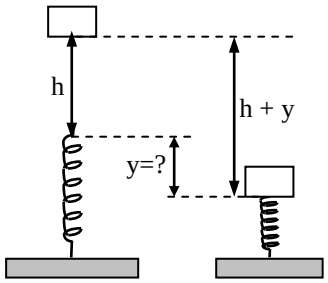
A) 16 B) 36 C) 48 D) 64 E) 72

12. A 1 kg block slides on a rough horizontal table top. Just before it hits a horizontal ideal spring its speed is 4 m/s. It compresses the spring 10 cm before coming to rest. If the spring constant is 1000 N/m, what is the increase in the internal energy (in J) of the block–table system?

A) 3 B) 6 C) 2 D) 4 E) 5

13. A block of mass 0.2 kg, initially at rest, is dropped from a height h = 1.2 m onto a spring whose spring constant is 20 N/m. What is the maximum amount of compression of the spring (in m)?

A) 0.5 B) 0.6 C) 0.2 D) 0.3 E) 0.8



14. The potential energy of a particle varies as $U(x) = 5x^2 – 3x + 7$ J, where x is in meters. What is the conservative force (in N) acting on the particle at x = 1 m?

A) $-5\mathbf{i}$ B) $5\mathbf{i}$ C) $-7\mathbf{i}$ D) $7\mathbf{i}$ E) $9\mathbf{i}$

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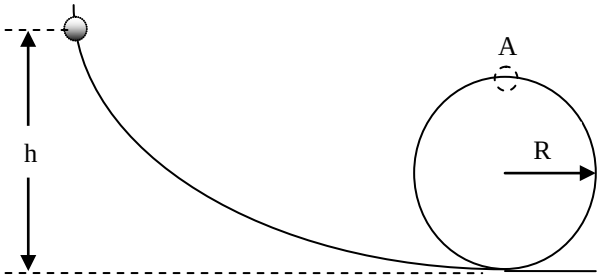
15. A bead slides along a frictionless wire as shown in the figure. If the bead is released from a height h = 3.5R, how is its speed expressed when it is at point A?



A) $(7gR)^{1/2}$ B) $(5gR)^{1/2}$ C) $2(gR)^{1/2}$ D) $(3gR)^{1/2}$ E) $(gR)^{1/2}$

16. A thin rod of length 1 m has linear density given by $\lambda(x) = 0.2+0.6x$ kg/m, where x is the distance from one end. How far (in m) is its center of mass from the x = 0 end?

A) 0.2 B) 0.3 C) 0.4 D) 0.5 E) 0.6

17. 3 kg and 2 kg carts approach each other on a horizontal air track. They collide and stick together. After the collision their total kinetic energy is 40 J. What is the speed of their center of mass (in m/s)?

A) 4 B) 5 C) 3 D) 2 E) 0

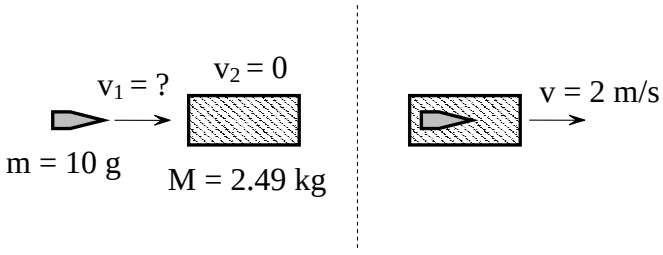
18. A mass of m_1 = 1 kg is acted on by a force $\mathbf{F}_1 = 2\mathbf{i}–4\mathbf{j}$ N, and another mass of m_2 = 3 kg is acted on by a force $\mathbf{F}_2 = –2\mathbf{i}+2\mathbf{j}$ N. What should be the acceleration (in m/s^2) of the center of the mass of the system?

A) 0.3**i** B) –0.5**j** C) 1.2**j** D) 0.5**j** E) 0.8**i**

19. An average force of 1000 N is applied for a duration of Δt = 20 ms to a 0.5 kg steel ball moving at a speed of 12 m/s. If the force is in a direction opposite the initial velocity of the ball, what is the final speed (in m/s) and direction of the ball with respect to its initial velocity?

A) 0 B) 32, opposite C) 28, opposite D) 32, same E) 28, same

20. A bullet with a mass of m = 10 g collides inelastically with a wooden block of mass M = 2.49 kg initially at rest, and is embedded in it. After the collision, the speed of the system is 2 m/s. What is the initial speed (in m/s) of the bullet?



A) 100 B) 200 C) 300 D) 400 E) 500

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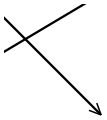


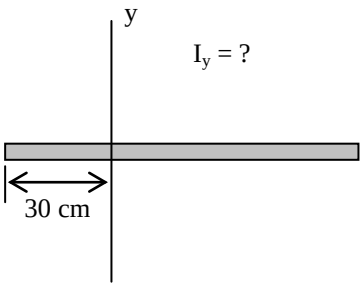
21. An object of mass m = 2 kg is moving in +x direction with a speed of v_{1i} = 8 m/s toward the second object of equal mass which is initially at rest and they collide. After the collision, the speed of the incident object is v_{1f} = 6.4 m/s and directed 37^o with the +x axis. If the collision is elastic and the target object is directed 53^o with +x axis, what is its speed (in m/s) after the collision?

A) 4.8 B) 5.2 C) 5.6 D) 6.4 E) 7.2

22. A disk, initially rotating at an angular velocity of 120 rad/s, is slowed down with a constant angular acceleration of 4 rad/s^2. Find the angular displacement (in rad) of the disk untill it stops?

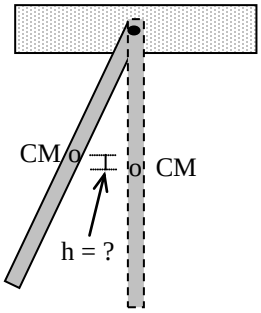
A) 2000 B) 1800 C) 1600 D) 1400 E) 1200

23. Calculate the rotational inertia (in kg·m^2) of a uniform rod with mass 0.6 kg and length 1 m, about an axis perpendicular to the thin rod and located 30 cm away from one end.



A) 0.024 B) 0.068 C) 0.074 D) 0.096 E) 1.000

24. A thin rod of length 0.5 m and mass 0.4 kg is suspended from one end. It is pulled aside and then allowed to swing, passing through its lowest position with an angular speed of 6.0 rad/s. How far (in cm) does the center of mass rise with respect to its equilibrium position?

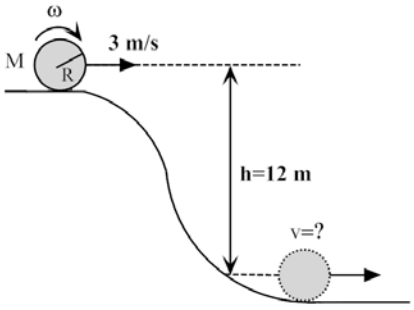


A) 2 B) 5 C) 9 D) 15 E) 25

25. An engine transfers energy to a system at the rate of 72 kW when it is rotating at a speed of 1800 rev/min. What is the torque (in N·m) acting on the engine?

A) 150 B) 200 C) 250 D) 300 E) 400

26. A solid disk with a mass M and radius R, rolls without slipping over the top of a hill with an initial speed of 3 m/s, as shown in the figure. If the friction losses are negligible, what will be its speed (in m/s) when it is 12 m below the top?



A) 13 B) 5 C) 8 D) 12 E) 25

27. A boy of mass 6 kg stands on a freely rotating platform with his arm extended; his angular speed is 0.25 rev/s. But when he draws them in, his angular speed becomes 1.0 rev/s. What is the ratio of his moment of inertia before and that of after?

A) 2 B) 24 C) 8 D) 16 E) 4

28. A mass of 3 kg moves on a frictionless horizontal surface along –x direction with a speed 50 m/s. The mass collides with a spring, compresses it and stops momentarily, then turns back and moves along +x direction with a speed of 40 m/s. What is the impulse (in N·s) exerted by the spring on the mass?

A) 30 B) –30 C) 270 D) –270 E) 90

29. An object of mass 150 g attached to a spring with negligible mass makes a simple harmonic motion with period T. The mechanical energy of the object is 40 mJ at t = T/4. The extension is expressed by $x(t) = 0.4\cos(\omega t)$, where x is in meters and t in seconds. What is the spring constant (in N/m)?

A) 0.95 B) 0.87 C) 0.80 D) 0.50 E) 0.25

30. A 0.2 kg body is oscillating on a spring that has a spring constant of 80 N/m. The instantaneous speed of the body is 4 m/s as it passes through its equilibrium position. What is the maximum acceleration (in m/s^2) of the body?

A) 32 B) 40 C) 80 D) 20 E) 16