Instructor(s): *Field/Matcheva*

PHYSICS DEPARTMENT

PHY 2048 Exam 1 September 26, 2014

Name (print, last first): ______________________ Signature: ______________________

On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.

(1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number)**. Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink**. Do not make any stray marks or some answers may be counted as incorrect.
(5) **The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.**
(6) Hand in the answer sheet separately.

Use $g = 9.80\ \text{m/s}^2$

PHY2048 Exam 1 Formula Sheet

Vectors

$\vec{a} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$ $\quad \vec{b} = b_x\hat{i} + b_y\hat{j} + b_z\hat{k}$ Magnitudes: $|\vec{a}| = \sqrt{a_x^2 + a_y^2 + a_z^2}$ $\quad |\vec{b}| = \sqrt{b_x^2 + b_y^2 + b_z^2}$

Scalar Product: $\vec{a}\cdot\vec{b} = a_xb_x + a_yb_y + a_zb_z$ Magnitude: $|\vec{a}\cdot\vec{b}| = |\vec{a}||\vec{b}|\cos\theta$ (θ = angle between $\vec{a}$ and $\vec{b}$)

Vector Product: $\vec{a}\times\vec{b} = (a_yb_z - a_zb_y)\hat{i} + (a_zb_x - a_xb_z)\hat{j} + (a_xb_y - a_yb_x)\hat{k}$

Magnitude: $|\vec{a}\times\vec{b}| = |\vec{a}||\vec{b}|\sin\theta$ (θ = smallest angle between $\vec{a}$ and $\vec{b}$)

Motion

Displacement: $\Delta x = x(t_2) - x(t_1)$ (1 dimension) $\quad \Delta\vec{r} = \vec{r}(t_2) - \vec{r}(t_1)$ (3 dimensions)

Average Velocity: $v_{ave} = \dfrac{\Delta x}{\Delta t} = \dfrac{x(t_2) - x(t_1)}{t_2 - t_1}$ (1 dim) $\quad \vec{v}_{ave} = \dfrac{\Delta\vec{r}}{\Delta t} = \dfrac{\vec{r}(t_2) - \vec{r}(t_1)}{t_2 - t_1}$ (3 dim)

Average Speed: s_{ave} = (total distance)/Δt

Instantaneous Velocity: $v(t) = \dfrac{dx(t)}{dt}$ (1 dim) $\quad \vec{v}(t) = \dfrac{d\vec{r}(t)}{dt}$ (3 dim)

Relative Velocity: $\vec{v}_{AC} = \vec{v}_{AB} + \vec{v}_{BC}$ (3 dim)

Average Acceleration: $a_{ave} = \dfrac{\Delta v}{\Delta t} = \dfrac{v(t_2) - v(t_1)}{t_2 - t_1}$ (1 dim) $\quad \vec{a}_{ave} = \dfrac{\Delta\vec{v}}{\Delta t} = \dfrac{\vec{v}(t_2) - \vec{v}(t_1)}{t_2 - t_1}$ (3 dim)

Instantaneous Acceleration: $a(t) = \dfrac{dv(t)}{dt} = \dfrac{d^2x(t)}{dt^2}$ (1 dim) $\quad \vec{a}(t) = \dfrac{d\vec{v}(t)}{dt} = \dfrac{d^2\vec{r}(t)}{dt^2}$ (3 dim)

Equations of Motion (Constant Acceleration)

$v_x(t) = v_{x0} + a_xt$ $\qquad v_y(t) = v_{y0} + a_yt$ $\qquad v_z(t) = v_{z0} + a_zt$

$x(t) = x_0 + v_{x0}t + \frac{1}{2}a_xt^2$ $\qquad y(t) = y_0 + v_{y0}t + \frac{1}{2}a_yt^2$ $\qquad z(t) = z_0 + v_{z0}t + \frac{1}{2}a_zt^2$

$v_x^2(t) = v_{x0}^2 + 2a_x(x(t) - x_0)$ $\qquad v_y^2(t) = v_{y0}^2 + 2a_y(y(t) - y_0)$ $\qquad v_z^2(t) = v_{z0}^2 + 2a_z(z(t) - z_0)$

Newton's Law and Weight

$\vec{F}_{net} = m\vec{a}$ (m = mass) Weight (near the surface of the Earth) = W = mg (use g = 9.8 m/s^2)

Magnitude of the Frictional Force

(μ_s = static coefficient of friction, μ_k = kinetic coefficient of friction)

Static: $(f_s)_{\max} = \mu_sF_N$ Kinetic: $f_k = \mu_kF_N$ (F_N is the magnitude of the normal force)

Uniform Circular Motion (Radius R, Tangential Speed v = Rω, Angular Velocity ω)

Centripetal Acceleration & Force: $a = \dfrac{v^2}{R} = R\omega^2$ $\quad F = \dfrac{mv^2}{R} = mR\omega^2$ Period: $T = \dfrac{2\pi R}{v} = \dfrac{2\pi}{\omega}$

Projectile Motion

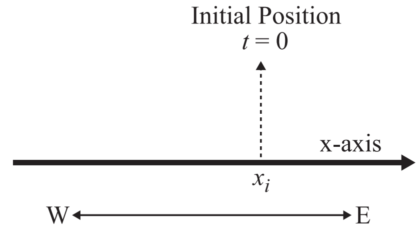
(horizontal surface near Earth, v_0 = initial speed, θ_0 = initial angle with horizontal)

Range: $R = \dfrac{v_0^2\sin(2\theta_0)}{g}$ Max Height: $H = \dfrac{v_0^2\sin^2\theta_0}{2g}$ Time (of flight): $t_f = \dfrac{2v_0\sin\theta_0}{g}$

Quadratic Formula

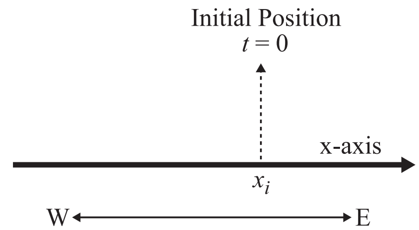
If: $ax^2 + bx + c = 0$ Then: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1. A train traveling along the x-axis is initially at the point x_i at $t = 0$. The train then travels 10 km to the East (*i.e.,* right) as shown in the figure. It then reverses direction and travels a distance d to the West (*i.e.,* left) to the final point x_f. If the train's average speed for this trip was 15 km/h, and its average velocity for the trip was -10 km/h, what was the distance d (in km)?



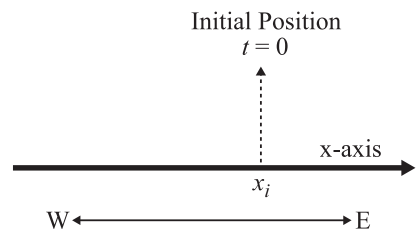
(1) 50 (2) 30 (3) 20 (4) 10 (5) 40

2. A train traveling along the x-axis is initially at the point x_i at $t = 0$. The train then travels 10 km to the East (*i.e.,* right) as shown in the figure. It then reverses direction and travels a distance d to the West (*i.e.,* left) to the final point x_f. If the train's average speed for this trip was 20 km/h, and its average velocity for the trip was -10 km/h, what was the distance d (in km)?



(1) 30 (2) 50 (3) 20 (4) 10 (5) 40

3. A train traveling along the x-axis is initially at the point x_i at $t = 0$. The train then travels 10 km to the East (*i.e.,* right) as shown in the figure. It then reverses direction and travels a distance d to the West (*i.e.,* left) to the final point x_f. If the train's average speed for this trip was 30 km/h, and its average velocity for the trip was -10 km/h, what was the distance d (in km)?



(1) 20 (2) 50 (3) 30 (4) 10 (5) 40

4. An object is released from rest at $t = 0$ near the surface of an unknown planet (not Earth) and falls 10 meters during the time interval from $t = 0$ s to $t = 2$ s. Ignoring atmospheric resistance, how far does it fall (in m) during the time interval from $t = 2$ s to $t = 3$ s?

(1) 12.5 m (2) 30.0 m (3) 52.5 m (4) 24.5 m (5) 102.9 m

5. An object is released from rest at $t = 0$ near the surface of an unknown planet (not Earth) and falls 10 meters during the time interval from $t = 0$ s to $t = 2$ s. Ignoring atmospheric resistance, how far does it fall (in m) during the time interval from $t = 2$ s to $t = 4$ s?

(1) 30.0 m (2) 12.5 m (3) 52.5 m (4) 24.5 m (5) 102.9 m

6. An object is released from rest at $t = 0$ near the surface of an unknown planet (not Earth) and falls 10 meters during the time interval from $t = 0$ s to $t = 2$ s. Ignoring atmospheric resistance, how far does it fall (in m) during the time interval from $t = 2$ s to $t = 5$ s?

(1) 52.5 m (2) 12.5 m (3) 30.0 m (4) 24.5 m (5) 102.9 m

7. A motorist drives along a straight road at a constant speed of 80 m/s. At $t = 0$ she passes a parked motorcycle police officer, and the officer takes off after her with acceleration, $a(t) = bt$, where b is a constant and t is the time (*i.e.,* the acceleration varies linearly with time). If the officer maintains this rate of acceleration, what is the speed of the police officer when he reaches the motorist (in m/s)?

(1) 240 (2) 255 (3) 270 (4) 160 (5) 170

8. A motorist drives along a straight road at a constant speed of 85 m/s. At $t = 0$ she passes a parked motorcycle police officer, and the officer takes off after her with acceleration, $a(t) = bt$, where b is a constant and t is the time (*i.e.,* the acceleration varies linearly with time). If the officer maintains this rate of acceleration, what is the speed of the police officer when he reaches the motorist (in m/s)?

(1) 255 (2) 240 (3) 270 (4) 160 (5) 170

9. A motorist drives along a straight road at a constant speed of 90 m/s. At $t = 0$ she passes a parked motorcycle police officer, and the officer takes off after her with acceleration, $a(t) = bt$, where b is a constant and t is the time (*i.e.,* the acceleration varies linearly with time). If the officer maintains this rate of acceleration, what is the speed of the police officer when he reaches the motorist (in m/s)?

(1) 270 (2) 240 (3) 255 (4) 160 (5) 180

10. Near the surface of the Earth a suspension bridge is a height H above the level base of a gorge. A stone is thrown or dropped from the bridge. Ignore air resistance. If you drop the stone from rest, it takes 3 seconds for it to fall to the base of the gorge. If you throw the same stone straight down with a speed of 10 m/s, how long (in s) before it hits the ground?

(1) 2.15 (2) 1.84 (3) 1.59 (4) 1.25 (5) 0.83

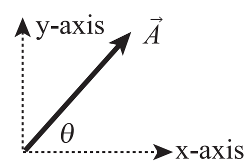
11. Near the surface of the Earth a suspension bridge is a height H above the level base of a gorge. A stone is thrown or dropped from the bridge. Ignore air resistance. If you drop the stone from rest, it takes 3 seconds for it to fall to the base of the gorge. If you throw the same stone straight down with a speed of 15 m/s, how long (in s) before it hits the ground?

(1) 1.84 (2) 2.15 (3) 1.59 (4) 1.25 (5) 0.83

12. Near the surface of the Earth a suspension bridge is a height H above the level base of a gorge. A stone is thrown or dropped from the bridge. Ignore air resistance. If you drop the stone from rest, it takes 3 seconds for it to fall to the base of the gorge. If you throw the same stone straight down with a speed of 20 m/s, how long (in s) before it hits the ground?

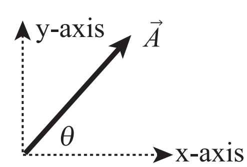
(1) 1.59 (2) 2.15 (3) 1.84 (4) 1.25 (5) 0.83

13. If the x-component of the vector $\vec{A}$ shown in the figure is 10 and the angle it makes with the x-axis $\theta = 50°$, what is the y-component?



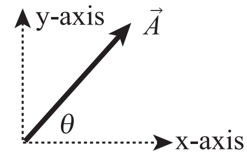
(1) 11.92 (2) 17.32 (3) 27.47 (4) 9.25 (5) 8.45

14. If the x-component of the vector $\vec{A}$ shown in the figure is 10 and the angle it makes with the x-axis $\theta = 60°$, what is the y-component?



(1) 17.32 (2) 11.92 (3) 27.47 (4) 9.25 (5) 8.45

15. If the x-component of the vector $\vec{A}$ shown in the figure is 10 and the angle it makes with the x-axis $\theta = 70°$, what is the y-component?



(1) 27.47 (2) 11.92 (3) 17.32 (4) 9.25 (5) 8.45

16. If $\vec{A}+\vec{B}=2\vec{C}$, $\vec{A}-\vec{B}=\vec{C}$, and $\vec{C}=2\hat{\imath}-2\hat{\jmath}$, then what is the value of the scalar product $\vec{A}\cdot\vec{B}$?

(1) 6 (2) 15 (3) 30 (4) 3 (5) 2

17. If $\vec{A}+\vec{B}=2\vec{C}$, $\vec{A}-\vec{B}=\vec{C}$, and $\vec{C}=2\hat{\imath}-4\hat{\jmath}$, then what is the value of the scalar product $\vec{A}\cdot\vec{B}$?

(1) 15 (2) 6 (3) 30 (4) 3 (5) 2

18. If $\vec{A}+\vec{B}=2\vec{C}$, $\vec{A}-\vec{B}=\vec{C}$, and $\vec{C}=2\hat{\imath}-6\hat{\jmath}$, then what is the value of the scalar product $\vec{A}\cdot\vec{B}$?

(1) 30 (2) 6 (3) 15 (4) 3 (5) 2

19. Two vectors have the same magnitude. If the magnitude of their vector product is twice the magnitude of their scalar product, what is the angle between them?

(1) 63.43° (2) 71.57° (3) 26.57° (4) 45.00° (5) 32.39°

20. Two vectors have the same magnitude. If the magnitude of their vector product is three times the magnitude of their scalar product, what is the angle between them?

(1) 71.57° (2) 63.43° (3) 26.57° (4) 45.00° (5) 32.39°

21. Two vectors have the same magnitude. If the magnitude of their vector product is one-half the magnitude of their scalar product, what is the angle between them?

(1) 26.57° (2) 63.43° (3) 71.57° (4) 45.00° (5) 32.39°

22. A projectile is launched from the position $x=y=0$ at an angle of θ with the horizontal axis. It reaches a maxiumu height H and travels a maximum horizontal distance R before landing back at $y=0$. If $H=2R$, what is the angle θ?

(1) 82.87° (2) 75.96° (3) 63.43° (4) 42.59° (5) 35.78°

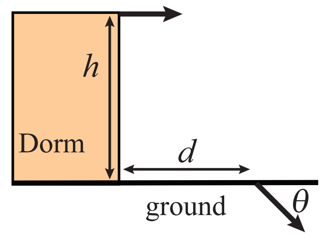
23. A projectile is launched from the position $x=y=0$ at an angle of θ with the horizontal axis. It reaches a maxiumu height H and travels a maximum horizontal distance R before landing back at $y=0$. If $H=R$, what is the angle θ?

(1) 75.96° (2) 82.87° (3) 63.43° (4) 42.59° (5) 35.78°

24. A projectile is launched from the position $x=y=0$ at an angle of θ with the horizontal axis. It reaches a maxiumu height H and travels a maximum horizontal distance R before landing back at $y=0$. If $H=R/2$, what is the angle θ?

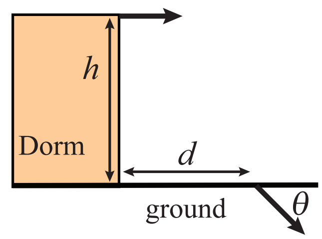
(1) 63.43° (2) 82.87° (3) 75.96° (4) 42.59° (5) 35.78°

25. A beanbag is thrown horizontally from a dorm room window. The height of the window is $h = 10$ meters above the ground as shown in the figure. If the beanbag's velocity just before impact with the ground is $\theta = 30°$ below the horizontal, at what horizontal distance d (in m) from the dorm directly below the window from which it was thrown does the beanbag hit the ground? Ignore air resistance.



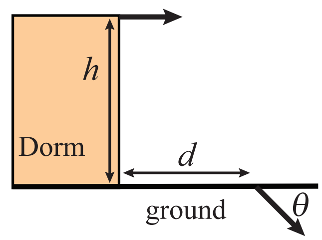
(1) 34.6 (2) 28.6 (3) 23.8 (4) 42.8 (5) 10.5

26. A beanbag is thrown horizontally from a dorm room window. The height of the window is $h = 10$ meters above the ground as shown in the figure. If the beanbag's velocity just before impact with the ground is $\theta = 35°$ below the horizontal, at what horizontal distance d (in m) from the dorm directly below the window from which it was thrown does the beanbag hit the ground? Ignore air resistance.



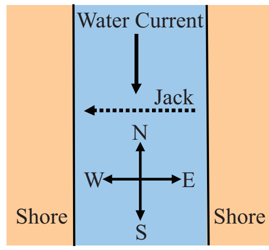
(1) 28.6 (2) 34.6 (3) 23.8 (4) 42.8 (5) 10.5

27. A beanbag is thrown horizontally from a dorm room window. The height of the window is $h = 10$ meters above the ground as shown in the figure. If the beanbag's velocity just before impact with the ground is $\theta = 40°$ below the horizontal, at what horizontal distance d (in m) from the dorm directly below the window from which it was thrown does the beanbag hit the ground? Ignore air resistance.



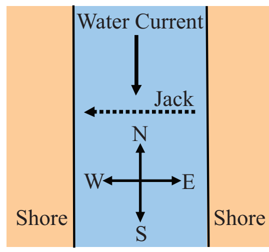
(1) 23.8 (2) 34.6 (3) 28.6 (4) 42.8 (5) 10.5

28. Jack wants to row directly across a river from the east shore to a point on the west shore, as shown in the figure. The width of the river is 250 m and the current flows from north to south at 0.5 m/s. The trip takes Jack 4 minutes. At what speed (in m/s) with respect to the still water is Jack able to row?



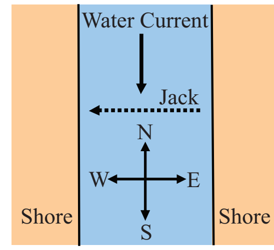
(1) 1.16
(2) 1.44
(3) 1.83
(4) 1.04
(5) 0.86

29. Jack wants to row directly across a river from the east shore to a point on the west shore, as shown in the figure. The width of the river is 250 m and the current flows from north to south at 1.0 m/s. The trip takes Jack 4 minutes. At what speed (in m/s) with respect to the still water is Jack able to row?



(1) 1.44
(2) 1.16
(3) 1.83
(4) 1.04
(5) 0.86

30. Jack wants to row directly across a river from the east shore to a point on the west shore, as shown in the figure. The width of the river is 250 m and the current flows from north to south at 1.5 m/s. The trip takes Jack 4 minutes. At what speed (in m/s) with respect to the still water is Jack able to row?



(1) 1.83
(2) 1.16
(3) 1.44
(4) 1.04
(5) 0.86

31. A small boat travels for 20 min 3 km north and then travels for 40 min 4 km east. What is the magnitude of the boat's average velocity (in km/h) for the one-hour trip?

(1) 5 (2) 10 (3) 15 (4) 7 (5) 14

32. A small boat travels for 20 min 6 km north and then travels for 40 min 8 km east. What is the magnitude of the boat's average velocity (in km/h) for the one-hour trip?

(1) 10 (2) 5 (3) 15 (4) 7 (5) 14

33. A small boat travels for 20 min 9 km north and then travels for 40 min 12 km east. What is the magnitude of the boat's average velocity (in km/h) for the one-hour trip?

(1) 15 (2) 5 (3) 10 (4) 7 (5) 21

34. A rabbit is dashing through the forest. Its position as a function of time is given by $\vec{r}(t) = (3-5t)\hat{i} + (3t^2 - 2t^3)\hat{j}$, where position is measured in meters and time in seconds. Find the magnitude of the rabbit's velocity (in m/s) at $t = 1$ s.

(1) 5 (2) 13 (3) 23 (4) 2 (5) 32

35. A rabbit is dashing through the forest. Its position as a function of time is given by $\vec{r}(t) = (3-5t)\hat{i} + (3t^2 - 2t^3)\hat{j}$, where position is measured in meters and time in seconds. Find the magnitude of the rabbit's velocity (in m/s) at $t = 2$ s.

(1) 13 (2) 5 (3) 23 (4) 2 (5) 32

36. A rabbit is dashing through the forest. Its position as a function of time is given by $\vec{r}(t) = (3-5t)\hat{i} + (3t^2 - 2t^3)\hat{j}$, where position is measured in meters and time in seconds. Find the magnitude of the rabbit's velocity (in m/s) at $t = 2.5$ s.

(1) 23 (2) 5 (3) 13 (4) 2 (5) 32

37. Near the surface of the Earth, a child pulls a sled up a snowy hill at a constant speed. What is the mass of the sled (in kg) if the child is pulling with a force of 19.6 N and the slope's angle is 30°? Neglect friction.

(1) 4 (2) 6 (3) 8 (4) 2 (5) 10

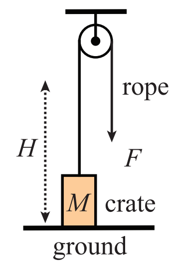
38. Near the surface of the Earth, a child pulls a sled up a snowy hill at a constant speed. What is the mass of the sled (in kg) if the child is pulling with a force of 29.4 N and the slope's angle is 30°? Neglect friction.

(1) 6 (2) 4 (3) 8 (4) 2 (5) 10

39. Near the surface of the Earth, a child pulls a sled up a snowy hill at a constant speed. What is the mass of the sled (in kg) if the child is pulling with a force of 39.2 N and the slope's angle is 30°? Neglect friction.

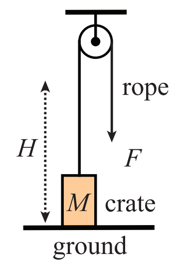
(1) 8 (2) 4 (3) 6 (4) 2 (5) 10

40. Near the surface of the Earth, a student is using a simple pulley to lift a crate of mass $M = 30$ kg from rest to a height H by pulling on the rope with a constant force F as shown in the figure. If the breaking strength of the rope is 400 N, what is the minimum time (in s) required for the student to haul the crate to a height $H = 20$ m? (Assume that the pulley is massless and frictionless.)



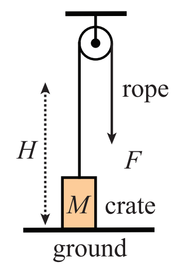
(1) 3.4
(2) 5.0
(3) 14.1
(4) 2.5
(5) 16.2

41. Near the surface of the Earth, a student is using a simple pulley to lift a crate of mass $M = 35$ kg from rest to a height H by pulling on the rope with a constant force F as shown in the figure. If the breaking strength of the rope is 400 N, what is the minimum time (in s) required for the student to haul the crate to a height $H = 20$ m? (Assume that the pulley is massless and frictionless.)



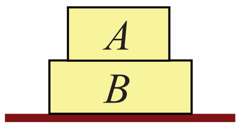
(1) 5.0
(2) 3.4
(3) 14.1
(4) 2.5
(5) 16.2

42. Near the surface of the Earth, a student is using a simple pulley to lift a crate of mass $M = 40$ kg from rest to a height H by pulling on the rope with a constant force F as shown in the figure. If the breaking strength of the rope is 400 N, what is the minimum time (in s) required for the student to haul the crate to a height $H = 20$ m? (Assume that the pulley is massless and frictionless.)



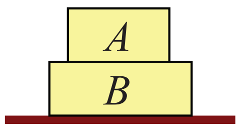
(1) 14.1
(2) 3.4
(3) 5.0
(4) 2.5
(5) 16.2

43. Near the surface of the Earth, two blocks (A and B) are at rest on a table as shown in the figure. If $M_A = 1$ kg and the magnitude of the normal force exerted by the table on block B is 29.4 N, what is the mass of block B (in kg)?



(1) 2 (2) 3 (3) 4 (4) 5 (5) 1

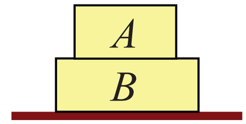
44. Near the surface of the Earth, two blocks (A and B) are at rest on a table as shown in the figure. If $M_A = 1$ kg and the magnitude of the normal force exerted by the table on block B is 39.2 N, what is the mass of block B (in kg)?



(1) 3 (2) 2 (3) 4 (4) 5 (5) 1

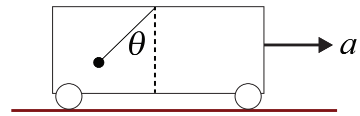
 77777

45. Near the surface of the Earth, two blocks (A and B) are at rest on a table as shown in the figure. If $M_A = 1$ kg and the magnitude of the normal force exerted by the table on block B is 49.0 N, what is the mass of block B (in kg)?



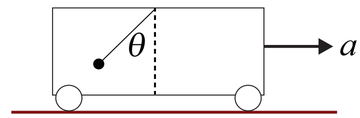
(1) 4 (2) 2 (3) 3 (4) 5 (5) 1

46. Consider a mass $M = 2$ kg suspended by a very light string from the ceiling of a railway car near the surface of the Earth. The car has a constant acceleration as shown in the figure, causing the mass to hang at an angle θ with the vertical. If the acceleration of the railway car is $a = 5$ m/s^2, what is the tension in the string (in N)?



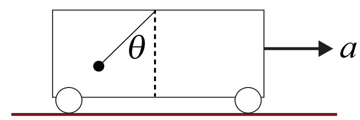
(1) 22.0 (2) 33.0 (3) 44.0 (4) 9.8 (5) 4.9

47. Consider a mass $M = 3$ kg suspended by a very light string from the ceiling of a railway car near the surface of the Earth. The car has a constant acceleration as shown in the figure, causing the mass to hang at an angle θ with the vertical. If the acceleration of the railway car is $a = 5$ m/s^2, what is the tension in the string (in N)?



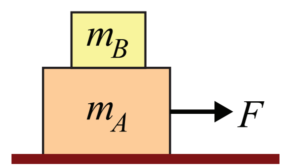
(1) 33.0 (2) 22.0 (3) 44.0 (4) 9.8 (5) 4.9

48. Consider a mass $M = 4$ kg suspended by a very light string from the ceiling of a railway car near the surface of the Earth. The car has a constant acceleration as shown in the figure, causing the mass to hang at an angle θ with the vertical. If the acceleration of the railway car is $a = 5$ m/s^2, what is the tension in the string (in N)?



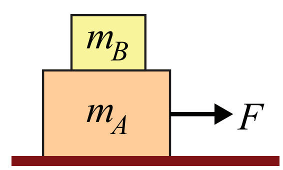
(1) 44.0 (2) 22.0 (3) 33.0 (4) 9.8 (5) 4.9

49. Near the surface of the Earth, block A, with mass m_A, is initially at rest on a horizontal floor. Block B, with mass m_B, is initially at rest on the horizontal top surface of A. The sum of the two masses is $m_A + m_B = 10$ kg. Block A is pulled with a horizontal force F as shown in the figure. If the coefficient of static friction between the two blocks is $\mu_s = 0.8$, and if block B begins to slide off block A when F is greater than 98 N, what is the kinetic coefficient of friction, μ_k, between block A and the floor?



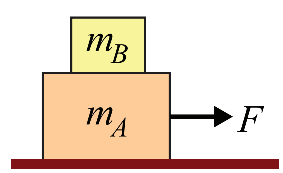
(1) 0.2 (2) 0.3 (3) 0.4 (4) 0.5 (5) 0.8

50. Near the surface of the Earth, block A, with mass m_A, is initially at rest on a horizontal floor. Block B, with mass m_B, is initially at rest on the horizontal top surface of A. The sum of the two masses is $m_A + m_B = 10$ kg. Block A is pulled with a horizontal force F as shown in the figure. If the coefficient of static friction between the two blocks is $\mu_s = 0.7$, and if block B begins to slide off block A when F is greater than 98 N, what is the kinetic coefficient of friction, μ_k, between block A and the floor?



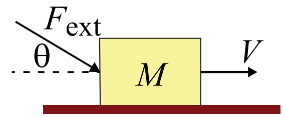
(1) 0.3 (2) 0.2 (3) 0.4 (4) 0.5 (5) 0.8

51. Near the surface of the Earth, block A, with mass m_A, is initially at rest on a horizontal floor. Block B, with mass m_B, is initially at rest on the horizontal top surface of A. The sum of the two masses is $m_A + m_B = 10$ kg. Block A is pulled with a horizontal force F as shown in the figure. If the coefficient of static friction between the two blocks is $\mu_s = 0.6$, and if block B begins to slide off block A when F is greater than 98 N, what is the kinetic coefficient of friction, μ_k, between block A and the floor?



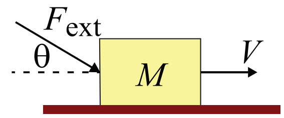
(1) 0.4 (2) 0.2 (3) 0.3 (4) 0.5 (5) 0.8

52. Near the surface of the Earth a block of mass $M = 10$ kg is pushed along the floor at a constant speed V by an external force $F_{\text{ext}} = 100$ N applied at a downward angle $\theta = 25°$ relative to the horizontal as shown in the figure. What is the coefficient of kinetic friction μ_k between the block and the floor?



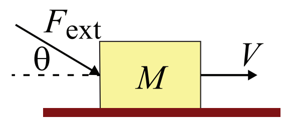
(1) 0.646 (2) 0.585 (3) 0.472 (4) 0.354 (5) 0.732

53. Near the surface of the Earth a block of mass $M = 10$ kg is pushed along the floor at a constant speed V by an external force $F_{\text{ext}} = 100$ N applied at a downward angle $\theta = 30°$ relative to the horizontal as shown in the figure. What is the coefficient of kinetic friction μ_k between the block and the floor?



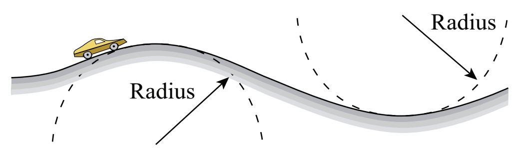
(1) 0.585 (2) 0.646 (3) 0.472 (4) 0.354 (5) 0.732

54. Near the surface of the Earth a block of mass $M = 10$ kg is pushed along the floor at a constant speed V by an external force $F_{\text{ext}} = 100$ N applied at a downward angle $\theta = 40°$ relative to the horizontal as shown in the figure. What is the coefficient of kinetic friction μ_k between the block and the floor?



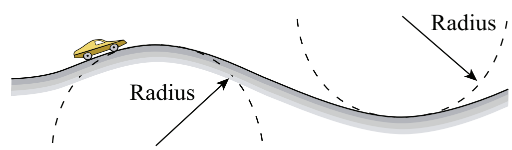
(1) 0.472 (2) 0.646 (3) 0.585 (4) 0.354 (5) 0.732

55. A man with a weight of 100 N drives a car at speed $v_1 = 40$ m/s over a circular hill and then into a circular valley with the same radius, but with speed v_2, as shown in the figure. At the top of the hill, the normal force on the man from the car seat is zero. If the magnitude of the normal force on the man from the seat when the car passes through the bottom of the valley is 500 N, what is the speed v_2 (in m/s)?



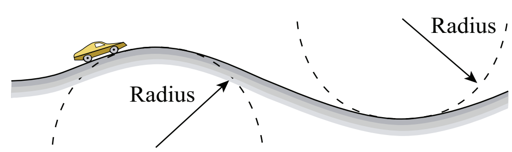
(1) 80 (2) 120 (3) 160 (4) 65 (5) 50

56. A man with a weight of 100 N drives a car at speed $v_1 = 40$ m/s over a circular hill and then into a circular valley with the same radius, but with speed v_2, as shown in the figure. At the top of the hill, the normal force on the man from the car seat is zero. If the magnitude of the normal force on the man from the seat when the car passes through the bottom of the valley is 1,000 N, what is the speed v_2 (in m/s)?



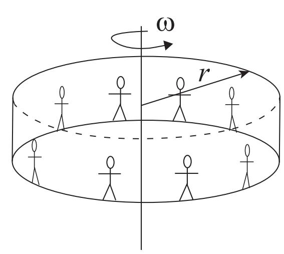
(1) 120 (2) 80 (3) 160 (4) 65 (5) 50

57. A man with a weight of 100 N drives a car at speed $v_1 = 40$ m/s over a circular hill and then into a circular valley with the same radius, but with speed v_2, as shown in the figure. At the top of the hill, the normal force on the man from the car seat is zero. If the magnitude of the normal force on the man from the seat when the car passes through the bottom of the valley is 1,700 N, what is the speed v_2 (in m/s)?



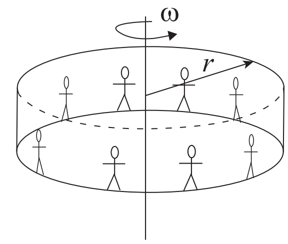
(1) 160 (2) 120 (3) 80 (4) 65 (5) 50

58. A carnival ride near the surface of the Earth consists of the riders standing against the inside wall of a cylindrical room with radius $R = 5.0$ m. The room spins about the vertical cylinder axis with a constant speed. Once it is up to speed, the floor of the room falls away. If the cylindrical room completes 16 revolutions per minute, what minimum coefficient of static friction between the riders and the wall will keep them from dropping with the floor?



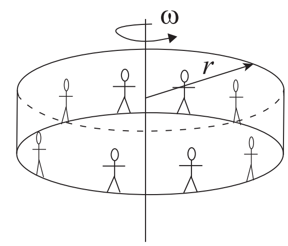
(1) 0.698 (2) 0.552 (3) 0.447 (4) 0.288 (5) 0.331

59. A carnival ride near the surface of the Earth consists of the riders standing against the inside wall of a cylindrical room with radius $R = 5.0$ m. The room spins about the vertical cylinder axis with a constant speed. Once it is up to speed, the floor of the room falls away. If the cylindrical room completes 18 revolutions per minute, what minimum coefficient of static friction between the riders and the wall will keep them from dropping with the floor?



(1) 0.552 (2) 0.698 (3) 0.447 (4) 0.288 (5) 0.331

60. A carnival ride near the surface of the Earth consists of the riders standing against the inside wall of a cylindrical room with radius $R = 5.0$ m. The room spins about the vertical cylinder axis with a constant speed. Once it is up to speed, the floor of the room falls away. If the cylindrical room completes 20 revolutions per minute, what minimum coefficient of static friction between the riders and the wall will keep them from dropping with the floor?



(1) 0.447 (2) 0.698 (3) 0.552 (4) 0.288 (5) 0.331

FOLLOWING GROUPS OF QUESTIONS WILL BE SELECTED AS ONE GROUP FROM EACH TYPE
TYPE 1
Q# S 1
Q# S 2
Q# S 3
TYPE 2
Q# S 4
Q# S 5
Q# S 6
TYPE 3
Q# S 7
Q# S 8
Q# S 9
TYPE 4
Q# S 10
Q# S 11
Q# S 12
TYPE 5
Q# S 13
Q# S 14
Q# S 15
TYPE 6
Q# S 16
Q# S 17
Q# S 18
TYPE 7
Q# S 19
Q# S 20
Q# S 21
TYPE 8
Q# S 22
Q# S 23
Q# S 24
TYPE 9
Q# S 25
Q# S 26
Q# S 27
TYPE 10
Q# S 28
Q# S 29
Q# S 30
TYPE 11
Q# S 31
Q# S 32
Q# S 33

TYPE 12
Q# S 34
Q# S 35
Q# S 36
TYPE 13
Q# S 37
Q# S 38
Q# S 39
TYPE 14
Q# S 40
Q# S 41
Q# S 42
TYPE 15
Q# S 43
Q# S 44
Q# S 45
TYPE 16
Q# S 46
Q# S 47
Q# S 48
TYPE 17
Q# S 49
Q# S 50
Q# S 51
TYPE 18
Q# S 52
Q# S 53
Q# S 54
TYPE 19
Q# S 55
Q# S 56
Q# S 57
TYPE 20
Q# S 58
Q# S 59
Q# S 60