Instructor(s): Field/Furic

## PHYSICS DEPARTMENT

PHY 2053 Exam 2 November 8, 2011

Name (print, last first):

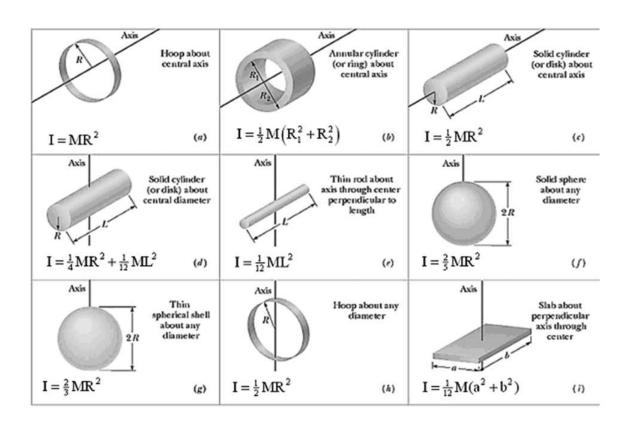
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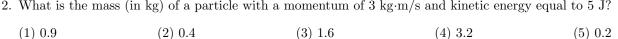
On my honor, I have neither given nor received unauthorized aid on this examination.

## 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 <u>blue</u> or <u>black</u> 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  $g = 9.80 \text{ m/s}^2$ 



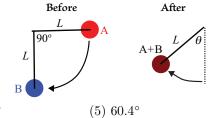


- 3. What is the mass (in kg) of a particle with a momentum of 4 kg·m/s and kinetic energy equal to 5 J?  $(1)\ 1.6$ (2) 0.9(3) 0.4(4) 3.2(5) 0.2
- 4. At time t=0, a 2 kg particle is located at  $\vec{r}=(2m)\hat{x}+(4m)\hat{y}$ , and its velocity is  $\vec{v}=-(6m/s)\hat{y}$ , and it is subject to the force  $\vec{F} = (8N)\hat{x}$ , where  $\hat{x}$  and  $\hat{y}$  are unit vectors in the x and y-direction, respectively. What are the magnitude of the angular momentum of the particle about the origin and the magnitude of the torque about the origin, respectively? (1)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $32 \text{ N} \cdot \text{m}$ 
  - (2)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $24 \text{ N} \cdot \text{m}$ (3)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $40 \text{ N} \cdot \text{m}$

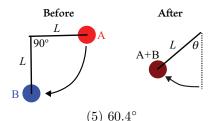
  - (4) 8 kg·m<sup>2</sup>/s; 32 N·m (5) 16 kg·m<sup>2</sup>/s; 24 N·m
- 5. At time t=0, a 2 kg particle is located at  $\vec{r}=(2m)\hat{x}+(3m)\hat{y}$ , and its velocity is  $\vec{v}=-(6m/s)\hat{y}$ , and it is subject to the force  $\vec{F} = (8N)\hat{x}$ , where  $\hat{x}$  and  $\hat{y}$  are unit vectors in the x and y-direction, respectively. What are the magnitude of the angular momentum of the particle about the origin and the magnitude of the torque about the origin, respectively?
  - (1)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $24 \text{ N} \cdot \text{m}$
  - (2)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $32 \text{ N} \cdot \text{m}$

  - (3) 24 kg·m²/s; 40 N·m (4) 8 kg·m²/s; 32 N·m (5) 16 kg·m²/s; 24 N·m
- 6. At time t=0, a 2 kg particle is located at  $\vec{r}=(2m)\hat{x}+(5m)\hat{y}$ , and its velocity is  $\vec{v}=-(6m/s)\hat{y}$ , and it is subject to the force  $\vec{F} = (8N)\hat{x}$ , where  $\hat{x}$  and  $\hat{y}$  are unit vectors in the x and y-direction, respectively. What are the magnitude of the angular momentum of the particle about the origin and the magnitude of the torque about the origin, respectively?
  - (1)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $40 \text{ N} \cdot \text{m}$
  - (2)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $24 \text{ N} \cdot \text{m}$
  - (3)  $24 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $32 \text{ N} \cdot \text{m}$
  - (4)  $8 \text{ kg} \cdot \text{m}^2/\text{s}$ ;  $32 \text{ N} \cdot \text{m}$
  - (5) 16 kg·m<sup>2</sup>/s; 24 N·m
- 7. The coefficient of static friction between a certain cylinder with radius R and a horizontal floor is  $\mu_s$ . If the rotational inertia of the cylinder about its symmetry axis is given by  $I = MR^2/2$  and the magnitude of the maximum translational acceleration the cylinder can have without sliding is 7.84 m/s<sup>2</sup>, what is  $\mu_s$ ?
  - $(1)\ 0.4$
- $(2)\ 0.3$
- (3) 0.2
- (4) 0.6
- (5) 0.8

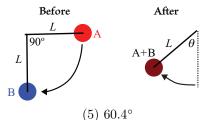
- 8. The coefficient of static friction between a certain cylinder with radius R and a horizontal floor is  $\mu_s$ . If the rotational inertia of the cylinder about its symmetry axis is given by  $I = MR^2/2$  and the magnitude of the maximum translational acceleration the cylinder can have without sliding is 5.88 m/s<sup>2</sup>, what is  $\mu_s$ ?
  - (1) 0.3
- (2) 0.4
- (3) 0.2
- (4) 0.6
- (5) 0.8
- 9. The coefficient of static friction between a certain cylinder with radius R and a horizontal floor is  $\mu_s$ . If the rotational inertia of the cylinder about its symmetry axis is given by  $I = MR^2/2$  and the magnitude of the maximum translational acceleration the cylinder can have without sliding is 3.92 m/s<sup>2</sup>, what is  $\mu_s$ ?
  - (1) 0.2
- (2) 0.3
- (3) 0.4
- (4) 0.6
- (5) 0.8
- 10. Two pendulum bobs have masses  $M_A=3$  kg and  $M_B=2$  kg and equal lengths L as shown in the figure. Bob A is initially held horizontally while bob B hangs vertically at rest. Bob A is released and collides with bob B. The two masses then stick together and swing upward to the right to a maximum angle  $\theta$ . What is the maximum swing angle  $\theta$ ?



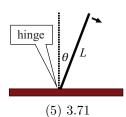
- $(1) 50.2^{\circ}$
- $(2) 32.9^{\circ}$
- $(3)\ 20.4^{\circ}$
- $(4) 45.0^{\circ}$



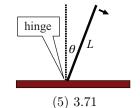
- 11. Two pendulum bobs have masses  $M_A=2$  kg and  $M_B=3$  kg and equal lengths L as shown in the figure. Bob A is initially held horizontally while bob B hangs vertically at rest. Bob A is released and collides with bob B. The two masses then stick together and swing upward to the right to a maximum angle  $\theta$ . What is the maximum swing angle  $\theta$ ?
  - $(1) 32.9^{\circ}$
- $(2)\ 50.2^{\circ}$
- $(3)\ 20.4^{\circ}$
- $(4) 45.0^{\circ}$
- 12. Two pendulum bobs have masses  $M_A=2$  kg and  $M_B=6$  kg and equal lengths L as shown in the figure. Bob A is initially held horizontally while bob B hangs vertically at rest. Bob A is released and collides with bob B. The two masses then stick together and swing upward to the right to a maximum angle  $\theta$ . What is the maximum swing angle  $\theta$ ?



- $(1)\ 20.4^{\circ}$
- $(2) 50.2^{\circ}$
- $(3) 32.9^{\circ}$
- $(4) 45.0^{\circ}$
- 13. A thin stick with mass M, length L, and moment of inertia  $ML^2/3$  is hinged at its lower end and allowed to fall freely as shown in the figure. If its length L=2 m and it starts from rest at an angle  $\theta=60^{\circ}$ , what is the speed (in m/s) of the free end of the stick when it hits the table?

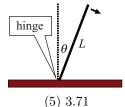


- (1) 5.42
- (2) 7.43
- (3) 6.71
- (4) 2.71
- 14. A thin stick with mass M, length L, and moment of inertia  $ML^2/3$  is hinged at its lower end and allowed to fall freely as shown in the figure. If its length L=2 m and it starts from rest at an angle  $\theta=20^{\circ}$ , what is the speed (in m/s) of the free end of the stick when it hits the table?

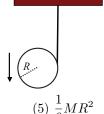


- (1) 7.43
- (2) 5.42
- (3) 6.71
- (4) 2.71

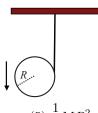
15. A thin stick with mass M, length L, and moment of inertia  $ML^2/3$  is hinged at its lower end and allowed to fall freely as shown in the figure. If its length L=2 m and it starts from rest at an angle  $\theta=40^\circ$ , what is the speed (in m/s) of the free end of the stick when it hits the table?



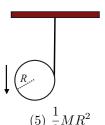
- (1) 6.71
- (2) 7.43
- (3) 5.42
- (4) 2.71
- 16. A cloth tape is wound around the outside of a non-uniform solid cylinder (mass M, radius R) and fastened to the ceiling as shown in the figure. The cylinder is held with the tape vertical and then release from rest. If the acceleration of the center-of-mass of the cylinder is 3q/4, what is its moment of inertia about its symmetry axis?



- (1)  $\frac{1}{3}MR^2$  (2)  $\frac{1}{2}MR^2$
- (3)  $MR^2$
- $(4) \frac{2}{3}MR^2$
- (5)  $\frac{1}{6}MR^2$
- 17. A cloth tape is wound around the outside of a non-uniform solid cylinder (mass M, radius R) and fastened to the ceiling as shown in the figure. The cylinder is held with the tape vertical and then release from rest. If the acceleration of the center-of-mass of the cylinder is 3g/5, what is its moment of inertia about its symmetry axis?

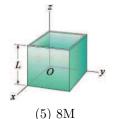


- $(1) \frac{2}{3}MR^2$ 
  - (2)  $\frac{1}{2}MR^2$
- (3)  $MR^2$
- $(4) \frac{1}{3}MR^2$
- $(5) \frac{1}{6}MR^2$
- 18. A cloth tape is wound around the outside of a non-uniform solid cylinder (mass M, radius R) and fastened to the ceiling as shown in the figure. The cylinder is held with the tape vertical and then release from rest. If the acceleration of the center-of-mass of the cylinder is 6g/7, what is its moment of inertia about its symmetry axis?



- $(1) \ \frac{1}{6}MR^2 \qquad \qquad (2) \ \frac{1}{2}MR^2$
- (3)  $MR^2$
- $(4) \frac{2}{3}MR^2$
- 19. A 0.5-kg rubber ball is dropped from rest a height H above the surface of the Earth. It strikes the sidewalk below and rebounds up to a maximum height of 4.9 m. If the magnitude of the impulse due to the collision with the sidewalk is 19.6 N·s, what is the height H (in meters)?
  - (1) 44.1
- $(2)\ 122.5$
- (3) 240.1
- (4) 9.8
- (5) 19.6
- 20. A 0.5-kg rubber ball is dropped from rest a height H above the surface of the Earth. It strikes the sidewalk below and rebounds up to a maximum height of 4.9 m. If the magnitude of the impulse due to the collision with the sidewalk is 29.4 N·s, what is the height H (in meters)?
  - (1) 122.5
- (2) 44.1
- (3) 240.1
- (4) 9.8
- (5) 19.6
- 21. A 0.5-kg rubber ball is dropped from rest a height H above the surface of the Earth. It strikes the sidewalk below and rebounds up to a maximum height of 4.9 m. If the magnitude of the impulse due to the collision with the sidewalk is 39.2 N·s, what is the height H (in meters)?
  - (1) 240.1
- (2) 122.5
- (3) 44.1
- (4) 9.8
- (5) 19.6

22. The figure shows a cubical box with each side consisting of a uniform metal plate of negligible thickness. Each of the four sides have mass, M, and the bottom has mass  $M_{\text{bottom}}$ . The box is open at the top (at z=L) and has edge length L. If the the z-coordinate of the center-of-mass is at  $z_{CM} = L/3$ , what is  $M_{\text{bottom}}$ ?



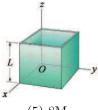
(1) 2M

(2) 4M

(3) 6M

(4) M

23. The figure shows a cubical box with each side consisting of a uniform metal plate of negligible thickness. Each of the four sides have mass, M, and the bottom has mass  $M_{\text{bottom}}$ . The box is open at the top (at z=L) and has edge length L. If the the z-coordinate of the center-of-mass is at  $z_{CM} = L/4$ , what is  $M_{\text{bottom}}$ ?

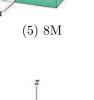


(1) 4M

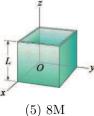
(2) 2M

(3) 6M

(4) M



24. The figure shows a cubical box with each side consisting of a uniform metal plate of negligible thickness. Each of the four sides have mass, M, and the bottom has mass  $M_{\rm bottom}$ . The box is open at the top (at z=L) and has edge length L. If the the z-coordinate of the center-of-mass is at  $z_{CM} = L/5$ , what is  $M_{\text{bottom}}$ ?



(1) 6M

(2) 4M

(3) 2M

(4) M

25. At the same instant that a 2.0-kg ball is dropped from 50 m above Earth, a second ball, with a mass of 1.0 kg, is thrown straight upward from Earth's surface with an initial speed of 20 m/s. They move along nearby lines and pass without colliding. What is the velocity of the center-of-mass of the two-ball system 0.5 seconds after the balls are released?

(1) 1.8 m/s, upward (2) 8.0 m/s, downward (3) 4.7 m/s, upward (4) 1.8 m/s, downward (5) 8.0 m/s, upward

26. At the same instant that a 2.0-kg ball is dropped from 50 m above Earth, a second ball, with a mass of 1.0 kg, is thrown straight upward from Earth's surface with an initial speed of 20 m/s. They move along nearby lines and pass without colliding. What is the velocity of the center-of-mass of the two-ball system 1.5 seconds after the balls are released?

(1) 8.0 m/s, downward (2) 1.8 m/s, upward (3) 4.7 m/s, upward (4) 1.8 m/s, downward (5) 8.0 m/s, upward

27. At the same instant that a 2.0-kg ball is dropped from 50 m above Earth, a second ball, with a mass of 1.0 kg, is thrown straight upward from Earth's surface with an initial speed of 20 m/s. They move along nearby lines and pass without colliding. What is the velocity of the center-of-mass of the two-ball system 0.2 seconds after the balls are released?

(1) 4.7 m/s, upward (2) 8.0 m/s, downward (3) 1.8 m/s, upward (4) 4.7 m/s, downward (5) 8.0 m/s, upward

28. A man is riding in a cart with mass M at speed v along a frictionless horizontal surface. He jumps off in such a way as to land on the ground with no horizontal velocity. If the new speed of the cart is 3v, what is the mass of the man?

 $(1) \ 2M$ 

 $(2) \ 3M$ 

 $(3) \, 4M$ 

(4) 5M

(5) M

29. A man is riding in a cart with mass M at speed v along a frictionless horizontal surface. He jumps off in such a way as to land on the ground with no horizontal velocity. If the new speed of the cart is 4v, what is the mass of the man?

 $(1) \ 3M$ 

 $(2) \ 2M$ 

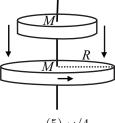
(3) 4M

 $(4) \ 5M$ 

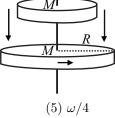
(5) M

- 30. A man is riding in a cart with mass M at speed v along a frictionless horizontal surface. He jumps off in such a way as to land on the ground with no horizontal velocity. If the new speed of the cart is 5v, what is the mass of the man?
  - (1) 4M
- (2) 3M
- (3) 2M
- (4) 5M
- (5) M

31. A uniform solid disk with mass M and radius R is mounted on a vertical shaft with negligible rotational inertia and is initially rotating with angular speed  $\omega$ . A non-rotating uniform solid disk with mass M and radius R/2 is suddenly dropped onto the same shaft as shown in the figure. The two disks stick together and rotate at the same angluar speed. What is the new angular speed of the two disk system?

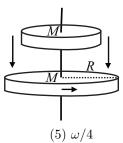


- (1)  $4\omega/5$
- (2)  $16\omega/25$
- (3)  $9\omega/13$
- (4)  $2\omega/3$

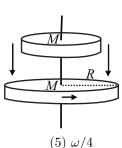


32. A uniform solid disk with mass M and radius R is mounted on a vertical shaft with negligible rotational inertia and is initially rotating with angular speed  $\omega$ . A non-rotating uniform solid disk with mass M and radius 3R/4 is suddenly dropped onto the same shaft as shown in the figure. The two disks stick together and rotate at the same angluar speed. What is the new angular speed of the two disk system?

33. A uniform solid disk with mass M and radius R is mounted on a vertical shaft with negligible rotational inertia and is initially rotating with angular speed  $\omega$ . A non-rotating uniform solid disk with mass M and radius 2R/3 is suddenly dropped onto the same shaft as shown in the figure. The two disks stick together and rotate at the same angluar speed. What is the new angular



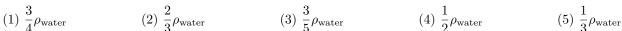
- $(1) 16\omega/25$
- (2)  $4\omega/5$
- (3)  $9\omega/13$
- (4)  $2\omega/3$



(1)  $9\omega/13$ 

speed of the two disk system?

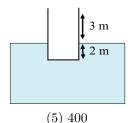
- (2)  $16\omega/25$  (3)  $4\omega/5$
- (4)  $2\omega/3$
- 34. Two small balls are simultaneously released from rest in a deep pool of water (with density  $\rho_{\text{water}}$ ). The first ball is released from rest at the surface of the pool and has a density 1.5 times the density of water (i.e.,  $\rho_1 = 1.5 \rho_{\text{water}}$ ). A second ball of unknown density is released from rest at the bottom of the pool. If it takes the second ball the same amount of time to reach the surface of the pool as it takes for the first ball to reach the bottom of the pool, what is the density of the second ball? Neglect hydrodynamic drag forces.



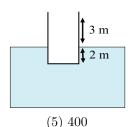
- 35. Two small balls are simultaneously released from rest in a deep pool of water (with density  $\rho_{\text{water}}$ ). The first ball is released from rest at the surface of the pool and has a density two times the density of water (i.e.,  $\rho_1 = 2\rho_{\text{water}}$ ). A second ball of unknown density is released from rest at the bottom of the pool. If it takes the second ball the same amount of time to reach the surface of the pool as it takes for the first ball to reach the bottom of the pool, what is the density of the second ball? Neglect hydrodynamic drag forces.
- (1)  $\frac{2}{3}\rho_{\text{water}}$  (2)  $\frac{3}{4}\rho_{\text{water}}$  (3)  $\frac{3}{5}\rho_{\text{water}}$  (4)  $\frac{1}{2}\rho_{\text{water}}$  (5)  $\frac{1}{3}\rho_{\text{water}}$

- 36. Two small balls are simultaneously released from rest in a deep pool of water (with density  $\rho_{\text{water}}$ ). The first ball is released from rest at the surface of the pool and has a density three times the density of water (i.e.,  $\rho_1 = 3\rho_{\rm water}$ ). A second ball of unknown density is released from rest at the bottom of the pool. If it takes the second ball the same amount of time to reach the surface of the pool as it takes for the first ball to reach the bottom of the pool, what is the density of the second ball? Neglect hydrodynamic drag forces.

- $(1) \ \frac{3}{5} \rho_{\text{water}} \qquad \qquad (2) \ \frac{2}{3} \rho_{\text{water}} \qquad \qquad (3) \ \frac{3}{4} \rho_{\text{water}} \qquad \qquad (4) \ \frac{1}{2} \rho_{\text{water}} \qquad \qquad (5) \ \frac{1}{3} \rho_{\text{water}}$
- 37. When a stone of weight W is suspended from a scale and submerged in water the scale reads 10 kg. When the same stone is suspended from a scale and submerged in oil the scale reads 12 kg. If the density of the oil is 0.8 the density of the water (i.e.,  $\rho_{\text{oil}} = 0.8 \rho_{\text{water}}$ ), what is the true weight W (in kg) of the stone?
  - (1) 20
- (2) 18
- $(3)\ 30$
- (4) 24
- (5) 35
- 38. When a stone of weight W is suspended from a scale and submerged in water the scale reads 10 kg. When the same stone is suspended from a scale and submerged in oil the scale reads 12 kg. If the density of the oil is 0.75 the density of the water (i.e.,  $\rho_{\rm oil} = 0.75 \rho_{\rm water}$ ), what is the true weight W (in kg) of the stone?
  - (1) 18
- $(2)\ 20$
- $(3)\ 30$
- (4) 24
- (5) 35
- 39. When a stone of weight W is suspended from a scale and submerged in water the scale reads 10 kg. When the same stone is suspended from a scale and submerged in oil the scale reads 12 kg. If the density of the oil is 0.9 the density of the water (i.e.,  $\rho_{\text{oil}} = 0.9 \rho_{\text{water}}$ ), what is the true weight W (in kg) of the stone?
  - $(1)\ 30$
- (2) 18
- $(3)\ 20$
- (4) 24
- (5) 35
- 40. A large cargo container has a square base with an area of 4 m<sup>2</sup> and height H = 5 m. When empty it floats on the water ( $\rho_{\text{water}} = 1,000 \text{ kg/m}^3$ ) with 3 meters above the surface of the water and 2 m below the surface as shown in the figure. The cargo container is being loaded with small 50-kg boxes. What is the maximum number boxes the cargo container can hold without sinking?

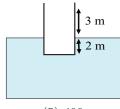


- (1) 240
- $(2)\ 300$
- (3) 200
- $(4)\ 150$
- 41. A large cargo container has a square base with an area of 4  $\mathrm{m}^2$  and height H = 5 m. When empty it floats on the water ( $\rho_{\text{water}} = 1,000 \text{ kg/m}^3$ ) with 3 meters above the surface of the water and 2 m below the surface as shown in the figure. The cargo container is being loaded with small 40-kg boxes. What is the maximum number boxes the cargo container can hold without sinking?



- $(1)\ 300$
- (2) 240
- (3) 200
- (4) 150
- 42. A large cargo container has a square base with an area of 4 m<sup>2</sup> and height H = 5 m. When empty it floats on the water ( $\rho_{\text{water}} = 1,000 \text{ kg/m}^3$ ) with 3 meters above the surface of the water and 2 m below the surface as shown in the figure. The cargo container is being loaded with small 60-kg boxes. What

is the maximum number boxes the cargo container can hold without sinking?



- (1) 200
- $(2)\ 300$
- (3) 240
- (4) 150
- (5) 400

	IS 50 III <sup>-</sup> .								
	(1) 148	(2) 76	(3) 183	(4) 191	(5) 48				
44.	1. Use Bernoulli's equation to estimate the upward force (in kN) on an airplane's wing if the average flow speed of the a $200 \text{ m/s}$ above the wing and $190 \text{ m/s}$ below the wing. The density of air is $1.3 \text{ kg/m}^3$ and the area of each wing sur is $30 \text{ m}^2$ .								
	(1) 76	(2) 148	(3) 183	(4) 191	(5) 48				
45. Use Bernoulli's equation to estimate the upward force (in kN) on an airplane's wing if the average flow s $200 \text{ m/s}$ above the wing and $175 \text{ m/s}$ below the wing. The density of air is $1.3 \text{ kg/m}^3$ and the area of e is $30 \text{ m}^2$ .									
	(1) 183	(2) 76	(3) 148	(4) 191	(5) 48				
46.	46. An ideal spring-and-mass system is undergoing simple harmonic motion (SHM). If the maximum speed and n acceleration of the mass are 2.0 m/s and 3.14 m/s <sup>2</sup> , respectively, what is the period of the oscillations (in s)?								
	(1) 4.0	(2) 6.0	(3) 8.0	(4) 2.0	(5) 0.5				
47.	An ideal spring-and-ma	um speed and maximum llations (in s)?							
	(1) 6.0	(2) 4.0	(3) 8.0	(4) 2.0	(5) 0.5				
48. An ideal spring-and-mass system is undergoing simple harmonic motion (SHM). If the maximum speed ar acceleration of the mass are 4.0 m/s and 3.14 m/s <sup>2</sup> , respectively, what is the period of the oscillations (in state of the content of the second of t									
	(1) 8.0	(2) 6.0	(3) 4.0	(4) 2.0	$(5) \ 0.5$				
49.	An ideal spring-and-mass system is undergoing simple harmonic motion (SHM) with period $T=3.14$ s. If the mass $m=0.5$ kg and the total energy of the spring-and-mass system is 5 J, what is the speed (in m/s) of the mass when the displacement is 2.0 m?								
	(1) 2.0	(2) 4.0	(3) 3.3	(4) 2.5	(5) 0.5				
50.	An ideal spring-and-ma $m = 0.5$ kg and the total displacement is 1.0 m?	T = 3.14 s. If the mass 's) of the mass when the							
	(1) 4.0	(2) 2.0	(3) 3.3	(4) 2.5	(5) 0.5				

51. An ideal spring-and-mass system is undergoing simple harmonic motion (SHM) with period T=3.14 s. If the mass m=0.5 kg and the total energy of the spring-and-mass system is 5 J, what is the speed (in m/s) of the mass when the displacement is 1.5 m?

 $(1) \ 3.3$ 

(2) 4.0

(3) 2.0

(4) 2.5

(5) 0.5

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52.	2. In the figure, two blocks ( $m = 5$ kg and $M = 15$ kg) and a spring ( $k = 196$ N/m) are arranged on a horizontal frictionless surface. If the smaller block begins to slip when the amplitude of the simple harmonic motion is greater than 0.5 m, what is the coefficient of static friction between the two blocks? (Assume that the system is near the surface of the Earth.)								
	(1) 0.50	(2) 0.40	(3) 0.37	$(4) \ 0.67$	$(5) \ 0.25$				
53.	In the figure, two blocks $(m = 10 \text{ kg and } M = 15 \text{ kg})$ and a spring $(k = 196 \text{ N/m})$ are arranged on a horizontal frictionless surface. If the smaller block begins to slip when the amplitude of the simple harmonic motion is greater than 0.5 m, what is the coefficient of static friction between the two blocks? (Assume that the system is near the surface of the Earth.)								
	(1) 0.40	(2) 0.50	(3) 0.37	$(4) \ 0.67$	$(5) \ 0.25$				
54.	In the figure, two blocks $(m = 12 \text{ kg and } M = 15 \text{ kg})$ and a spring $(k = 196 \text{ N/m})$ are arranged on a horizontal frictionless surface. If the smaller block begins to slip when the amplitude of the simple harmonic motion is greater than 0.5 m, what is the coefficient of static friction between the two blocks? (Assume that the system is near the surface of the Earth.)								
	(1) 0.37	(2) 0.40	$(3) \ 0.50$	$(4) \ 0.67$	$(5) \ 0.25$				
55.	A simple pendulum has a length $L$ . If its period is $T$ when it is on the surface of the Earth (gravitational acceleration $g$ ), what is its period when it is on the surface of a planet with gravitational acceleration equal to $4g$ ?								
	(1) $T/2$	(2) 2T	(3) 4T	(4) $T/4$	(5) T				
56.	A simple pendulum has a length $L$ . If its period is $T$ when it is on the surface of the Earth (gravitational acceleratio $g$ ), what is its period when it is on the surface of a planet with gravitational acceleration equal to $16g$ ?								
	(1) T/4	(2) 2T	(3) 4T	(4) $T/2$	(5) T				
57.	A simple pendulum has a length $L$ . If its period is $T$ when it is on the surface of the Earth (gravitational acceleration $g$ ), what is its period when it is on the surface of a planet with gravitational acceleration equal to $g/16$ ?								
	(1) 4T	(2) 2T	(3) T/2	(4) $T/4$	(5) T				
58.	. A 2,000 kg wrecking ball is to be lifted by a crane with a steel cable that has a diameter of 2.0 cm and an unstretched length of 31.4 m. The Young's modulus of steel is $2.0 \times 10^{11}$ Pa. Ignoring the weight of the cable itself, when the ball is lifted and held at rest how much does the cable stretch (in cm)?								
	(1) 0.98	$(2) \ 3.92$	(3) 1.74	$(4) \ 0.24$	$(5) \ 4.25$				

59. A 2,000 kg wrecking ball is to be lifted by a crane with a steel cable that has a diameter of 1.0 cm and an unstretched length of 31.4 m. The Young's modulus of steel is  $2.0 \times 10^{11}$ Pa. Ignoring the weight of the cable itself, when the ball is lifted and held at rest how much does the cable stretch (in cm)?

(3) 1.74

(1) 3.92

(2) 0.98

(4) 0.24

(5) 4.25

60. A 2,000 kg wrecking ball is to be lifted by a crane with a steel cable that has a diameter of 1.5 cm and an unstretched length of 31.4 m. The Young's modulus of steel is  $2.0 \times 10^{11}$  Pa. Ignoring the weight of the cable itself, when the ball is lifted and held at rest how much does the cable stretch (in cm)?

(1) 1.74

(2) 3.92

(3) 0.98

(4) 0.24

(5) 4.25

FOLLOWING GROUPS OF QUESTIONS WILL BE SELECTED AS ONE GROUP FROM EACH TYPE

TYPE 1  $\begin{smallmatrix} Q\# & S & 1 \\ Q\# & S & 2 \end{smallmatrix}$ 

Q# S 3 TYPE 2

Q# S 4 Q# S 5 Q# S 6 TYPE 3

Q# S 7 Q# S 8

 $\tilde{Q}_{\#}^{"} \tilde{S} \tilde{9}$ 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

 $\begin{array}{ccc} \mathbf{Q} \# \ \mathbf{S} \ 25 \\ \mathbf{Q} \# \ \mathbf{S} \ 26 \end{array}$ 

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

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 $\begin{array}{c} \text{Q\# S 47} \\ \text{Q\# S 48} \\ \text{TYPE 17} \\ \text{Q\# S 49} \\ \text{Q\# S 50} \\ \text{Q\# S 51} \\ \text{TYPE 18} \\ \text{Q\# S 52} \\ \text{Q\# S 53} \\ \text{Q\# S 54} \\ \text{TYPE 19} \\ \text{Q\# S 55} \\ \text{Q\# S 56} \\ \text{Q\# S 57} \\ \text{TYPE 20} \\ \text{Q\# S 58} \\ \text{Q\# S 59} \\ \text{Q\# S 60} \end{array}$