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Physics 2 – Summer Session 2009
Midterm

Question 1

Two planets of radii R_1 and R_2 have the same density. Their respective accelearations at the surface are g_1 and g_2. The ratio g_1/g_2 is

(a) R_2 / R_1
(b) $(R_1 / R_2)^2$
(c) $(R_2 / R_1)^2$
(d) R_1 / R_2

Question 2

A planet is moving around the Sun in a circular orbit of circumference C. The work done on the planet during one revolution by the gravitational force F of the Sun is

(a) F/C
(b) FC
(c) zero
(d) ½ FC
(e) ¼ FC

Question 3

If the escape velocity of a rocket from the surface of the Earth is V, then the escape velocity of the same rocket from the surface of a planet whose acceleration due to gravity as well as radius are 4 times that of the Earth is

(a) 16V
(b) 4V
(c) V
(d) V/4
(e) V/16

Question 4

Figure 1 shows a bar half wood and half steel. It is pivoted at the wood end at O_1. A force F is applied to the steel end. The angular acceleration is α_1. In Figure 2 the situation is reversed: the bar pivots at the steel end (O_2) and the same force F is applied at the wood end. The acceleration is α_2. Which is true:

(a) $\alpha_1 > \alpha_2$
(b) $\alpha_1 < \alpha_2$
(c) $\alpha_1 = \alpha_2$
(d) insufficient information

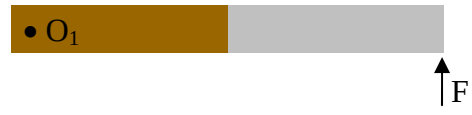


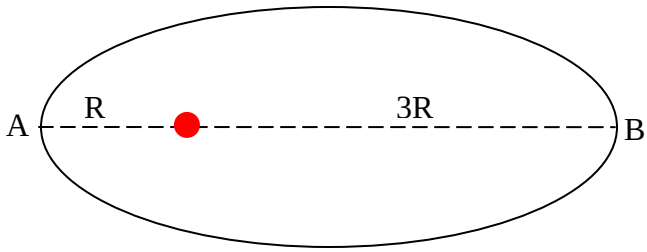
Figure 1

Figure 2

Question 5

The figure below shows the elliptical orbit of a satellite around the sun. The position of the sun is indicated by the red dot. The velocities of the satellite at A and B are v_A and v_B. Which is true?

(a) $v_A = v_B$
(b) $v_A = 3\ v_B$
(c) $v_A = v_B / 3$
(d) not enough information



Question 6

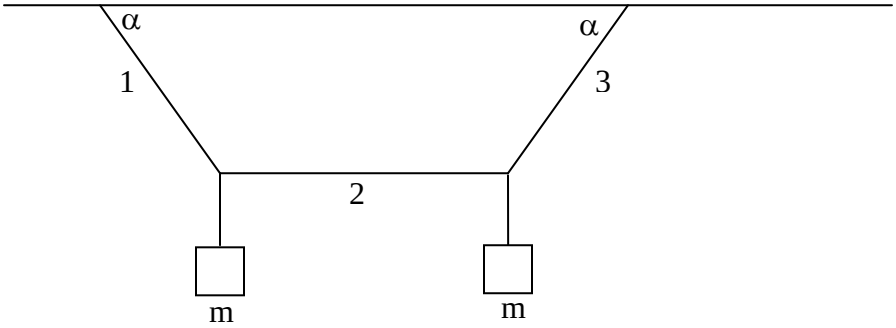
A wheel rotates about an axis and slows down uniformly from 300 revolutions per minute (rpms) to 100 rpms in 2 minutes. The magnitude of the angular acceleration in radians/minute^2 is

(a) $10/\pi$
(b) 100
(c) 100π
(d) 200π

Question 7

Two identical masses are suspended symmetrically, as shown, so that T_1, the tension along string 1, is equal to T_3, the tension along string 3. The tension T_2 along string 2 is given by

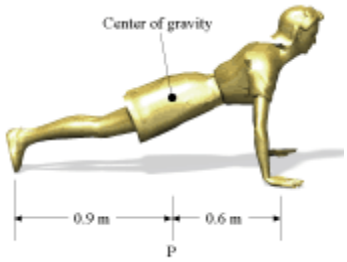
(a) $T_1 \cos\alpha$
(b) $T_1 \sin\alpha$
(c) $2T_1 \cos\alpha$
(d) $2T_1 \sin\alpha$



Question 8

A girl is about to do a push-up. Her center of gravity lies directly above point P on the floor, which is 0.9 m from her feet and 0.6 m from her hands. If her mass is 46 Kg, the force exerted by the floor on her hands is

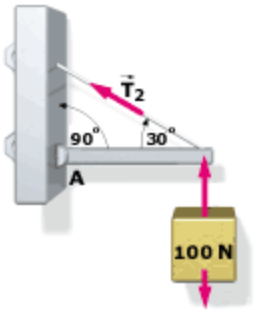
(a) 301 N
(b) 270 N
(c) 677 N
(d) 180 N
(e) none of the above



Question 9

A 100 N weight is supported by a cable attached to a strut hinged at point A as shown in the figure. The strut is supported by a second cable under tension T_2. The mass of the strut is negligible. The tension T_2 is

(a) 86.6 N
(b) 200 N
(c) 100 N
(d) 50 N
(e) none of the above



Question 10

The height of the center of gravity of a woman standing erect is determined by weighing her as she lies on a board of negligible weight supported by two scales. If the woman height is 170 cm and the scale under her head reads 420 N while the scale under her feet reads 380 N, the center of gravity, relative to her feet, is at

(a) 85.0 cm
(b) 91.4 cm
(c) 86.4 cm
(d) 89.2 cm
(e) none of the above

Question 11

The magnitude of the acceleration of an oscillator of amplitude A and angular frequency ω when its speed is at a maximum is

(a) ωA
(b) $\omega^2 A$
(c) A
(d) zero

Question 12

A particle initially at $x_0 = 20$ cm, has an initial speed $v_0 = 40$ cm/sec. If the period of its motion is 2 sec, the equation that represents its position as a function of time is

(a) $x = (23.7 \text{ cm}) \cos(\pi t - 0.567)$
(b) $x = (28.3 \text{ cm}) \cos(\pi t - 0.785)$
(c) $x = (23.7 \text{ cm}) \cos(\pi t + 0.567)$
(d) $x = (28.3 \text{ cm}) \cos(\pi t + 0.567)$
(e) none of the above

Question 13

A 0.5 Kg block attached to a spring of force constant 10 N/m oscillates with an amplitude of 6 cm. The magnitude of the acceleration of the block when it is at x=3 cm is

(a) 0.6 m/sec^2
(b) 0.4 m/sec^2
(c) zero
(d) impossible to determine without additional information
(e) none of the answers is correct

Question 14

A rod is 4.00 m long and is hinged at one end. The rod is initially held in the horizontal position, and then releases as the free end is allowed to fall. What is the angular acceleration as it is released? (The moment of inertia of a rod about one end is $ML^2/3$).

(a) 2.45 rad/sec^2
(b) 3.68 rad/sec^2
(c) 4.90 rad/sec^2
(d) 6.75 rad/sec^2

Question 15

A hoop of radius R=0.50 m and mass of 0.20 Kg is released from rest and allowed to roll down an inclined plane. How fast is it moving (ie, what is its linear velocity) after dropping a vertical distance of 3.0 m? (The moment of inertia of the hoop is MR^2)

(a) 2.2 m/sec
(b) 3.8 m/sec
(c) 5.4 m/sec
(d) 7.7 m/sec

Question 16

An ice skater performs a fast spin by pulling her outstretched arms close to her body. What happens to her rotational kinetic energy about the axis of rotation?

(a) it does not change
(b) it increases
(c) it decreases
(d) it changes, but with the available information it is impossible to tell which way

Question 17

Young's modulus is a proportionality constant that relates the force per unit area applied perpendicularly at the surface of an object to:

(a) the pressure
(b) the spring constant
(c) the fractional change in volume
(d) the fractional change in length

Question 18

The weight that will cause a wire of diameter d to stretch a given distance, for a fixed length of wire, is

(a) proportional to d^2
(b) proportional to d
(c) independent of d
(d) inversely proportional to d^2
(e) independent of the length of wire

Question 19

The kinetic energy and potential energy of a simple harmonic oscillator of amplitude A will be equal when the displacement is

(a) A/sqrt(2)
(b) sqrt(2)A
(c) A/2
(d) A/3
(e) A/sqrt(3)

Question 20

A 2-kg mass is moving along the *x* axis. The potential energy curve as a function of position is shown in the Figure. The system is conservative. There is no friction.
If the object is at rest at the origin, what will be its speed at 2.0 m along the +*x*-axis?

(a) 1.5 m/sec
(b) 2.5 m/sec
(c) 3.5 m/sec
(d) 4.5 m/sec
(e) 5.0 m/sec