Teorijska pitanja iz fizike (na engleskom) za provjeru znanja gradiva

Rotacija krutog tijela oko čvrste osi

1. Describe a situation in which $\omega < 0$ and ω and α are antiparallel.

> *The fact that ω is negative indicates that we are dealing with an object that is rotating in the clockwise direction. We also know that when ω and α are antiparallel, ω must be decreasing —the object is slowing down. Therefore, the object is spinning more and more slowly (with less and less angular speed) in the clockwise, or negative, direction. This has a linear analogy to a sky diver*
> *opening her parachute. The velocity is negative—downward. When the sky diver opens the parachute, a large upward force causes an upward acceleration. As a result, the acceleration and velocity vectors are in opposite directions. Consequently, the parachutist slows down.*

2. When a wheel of radius *R* rotates about a fixed axis, do all points on the wheel have (a) the same angular speed and (b) the same linear speed? If the angular speed is constant and equal to _, describe the linear speeds and linear accelerations of the points located at (c) $r = 0$, (d) $r = R/2$, and (e) $r = R$, all measured from the center of the wheel.

> *(a) Yes, all points on the wheel have the same angular speed. This is why we use angular quantities to describe rotational motion. (b) No, not all points on the wheel have the same linear speed. (c)$v = 0$, $a = 0$. (d) $v = R\omega/2$, $a = a_r=v^2/(R/2)=R\omega^2/2$, (at is zero at all points because ω is constant).(e)$v=R\omega$, $a=R\omega^2$.*

3. (a) Based on what you have learned from Example 10.5, what do you expect to find for the moment of inertia of two particles, each of mass *M*/2, located anywhere on a circle of radius *R* around the axis of rotation? (b) How about the moment of inertia of four particles, each of mass *M*/4, again located a distance *R* from the rotation axis?

> *(a) $I = MR^2$. (b) $I = MR^2$. The moment of inertia of a system of masses equidistant from an axis of rotation is always the sum of the masses multiplied by the square of the distance from the axis.*

4. For a hoop lying in the *xy* plane, which of the following requires that more work be done by an external agent to accelerate the hoop from rest to an angular speed ω: (a) rotation about the *z* axis through the center of the hoop, or (b) rotation about an axis parallel to *z* passing through a point *P* on the hoop rim?

> (b) Rotation about the axis through point *P* requires more work. The moment of inertia of the hoop about the center axis is *I*CM = *MR*2, whereas, by the parallelaxis theorem, the moment of inertia about the axis through point *P* is $I_P = I_{CM} + MR^2 = MR^2 + MR^2 = 2MR^2$.

Kotrljanje i kutna količina gibanja

1. Imagine that you slide your textbook across a gymnasium floor with a certain initial speed. It quickly stops moving because of friction between it and the floor. Yet, if you were to start a basketball rolling with the same initial speed, it would probably keep rolling from one end of the gym to the other. Why does a basketball roll so far? Doesn't friction affect its motion?

There is very little resistance to motion that can reduce the kinetic energy of the rolling ball. Even though there is friction between the ball and the floor (if there were not, then no rotation would occur, and the ball would slide), there is no relative motion of the two surfaces (by the definition of "rolling"), and so kinetic friction cannot reduce K. (Air drag and friction associated with deformation of the ball eventually stop the ball.)

2. Which gets to the bottom first: a ball rolling without sliding down incline A or a box sliding down a frictionless incline B having the same dimensions as incline A?

The box. Because none of the box's initial potential energy is converted to rotational kinetic energy, at any time $t > 0$ its translational kinetic energy is greater than that of the rolling ball.

3. Recall the skater described at the beginning of this section. What would be her angular momentum relative to the pole if she were skating directly toward it?

Zero. If she were moving directly toward the pole, ***r*** *and* ***p*** *would be antiparallel to each other, and the sine of the angle between them is zero; therefore, $L = 0$.*

4. A particle moves in a straight line, and you are told that the net torque acting on it is zero about some unspecified point. Decide whether the following statements are true or false: (a) The net force on the particle must be zero. (b) The particle's velocity must be constant.

Both (a) and (b) are false. The net force is not necessarily zero. If the line of action of the net force passes through the point, then the net torque about an axis passing through that point is zero even though the net force is not zero. Because the net force is not necessarily zero, you cannot conclude that the particle's velocity is constant.

5. How much work is done by the force of gravity when a top precesses through one complete circle?

Because it is perpendicular to the precessional motion of the top, the force of gravity does no work. This is a situation in which a force causes motion but does no work.

Gravitacija

1. How would you explain the fact that Saturn and Jupiter have periods much greater than one year?

Kepler's third law (Eq. 14.7), which applies to all the planets, tells us that the period of a planet is proportional to $r^{3/2}$*. Because Saturn and Jupiter are farther from the Sun than the Earth is, they have longer periods. The Sun's gravitational field is much weaker at Saturn and Jupiter than it is at the Earth. Thus, these planets experience much less centripetal acceleration than the Earth does, and they have correspondingly longer periods.*

2. If you were a space prospector and discovered gold on an asteroid, it probably would not be a good idea to jump up and down in excitement over your find. Why?

The mass of the asteroid might be so small that you would be able to exceed escape velocity by leg power alone. You would jump up, but you would never come back down!

Pitanja i odgovori preuzeti su iz knjige Fundamentals of Physics. Autori knjige su Halliday, Resnick i Walker. Neka pitanja nisu preuzeta jer se odnose na primjere iz knjige. Ako imate bilo kakvih problema u shvaćanju gradiva, ne bi bilo loše nabaviti ovu knjigu. Jednako kvalitetna je i knjiga University Physics with Modern Physics (Young, Freedman).