1 The Principle of Relativity states that

a. the laws of physics are the same in all inertial reference frames.

b. the laws of physics are the same in all moving reference frames.

c. all reference frames are the same.

d. everything is relative to the reference frame used to describe it.

2 You are sitting on a chair that is sitting on the floor of an elevator that is accelerating upward. Which of the following pairs of forces is an action-reaction pair?

a. Your weight and the force that the chair exerts on you.

b. The force that you exert on the chair and the force that the chair exerts on you.

c. The force that the chair exerts on you and the force that the chair exerts on the floor.

d. The force that you exert on the chair and the force that the floor exerts on the chair.

3 Which of the following objects is in equilibrium?

a. A thrown stone at its highest point.

b. Any object in free fall.

c. A baseball being thrown.

d. A rocket rising at a constant rate.

4 A nuclear rocket has an exhaust velocity of $10,000\,\mathrm{m/s}$ and expels reaction mass at the rate of $100\,\mathrm{kg/s}$. How much thrust does it generate?

a. $100,000\,\mathrm{N}$.

b. $100\,\mathrm{N}$.

c. $10,000\,\mathrm{N}$.

d. $1000\,\mathrm{N}$.

e. $1,000,000\,\mathrm{N}$.

5 A rocket with a mass of 2000kg turns and fires its engine sideways with a thrust of $200,000$N. Because of this thrust, the rocket must be accelerating

a. sideways at $90\mathrm{m/s}^2$.

b. upward at $90\mathrm{m/s}^2$.

c. upward at $100\mathrm{m/s}^2$.

d. sideways at $100\mathrm{m/s}^2$.

6 Newton's First Law of Mechanics, the law of inertia, implies that

a. moving objects require forces to keep them moving.

b. moving objects keep moving unless something stops them.

c. you always get charged more for labor than for parts.

d. acceleration is proportional to force.

e. the velocity of an object acted on by zero net force is zero.

7 Each of the following statements is included in Newton's three laws. Most of the statements are really just definitions that say something about the language that we use but nothing about the real world. One of the statements says something about physical reality. Which one?

a. Force is the cause of acceleration. The acceleration of an object is proportional to the force on it.

b. An object's resistance to acceleration depends only on the object and not at all on its surroundings.

c. Mass is resistance to acceleration. The acceleration of an object is inversely proportional to its mass.

d. An inertial frame is one in which Newton's Law of inertia is obeyed.

8 You are in an elevator that is moving downward at a constant acceleration of 10m/s^2. The floor pushes up against your feet with a force

a. equal to your weight.

b. less than your weight.

c. equal to twice your weight.

d. of zero.

9 When you step on the gas in your car, the wheels push against the ground and the ground pushes back. The force that makes the car accelerate is exerted by

a. the car wheels.

b. the car engine.

c. your foot.

d. the ground.

10 A rocket shoots 100 kg/s of exhaust out of its engine at an exhaust velocity of 3000 m/s (a reasonable exhaust velocity for a high performance rocket, by the way). How much force must the rocket exert on the exhaust?

a. 100 N.

b. 3,000,000 N.

c. 300 N.

d. 3000 N.

e. 300,000 N.

11 Another name for the unit Nm is the

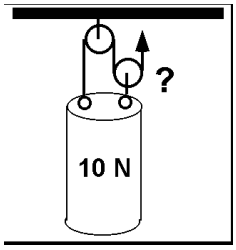
a. joule.

b. kilogram.

c. watt.

d. newton.

12 A ten newton weight is hung from the ceiling with the pulley system shown here. The force that must be exerted on the end of the string to hold the weight in equilibrium is



a. $20\,\mathrm{N}$.

b. $5\,\mathrm{N}$.

c. $10\,\mathrm{N}$.

d. $3\frac{1}{3}\,\mathrm{N}$.

13 A $1000\,\mathrm{kg}$ car travels north with a speed of $40\,\mathrm{m/s}$. A $2000\,\mathrm{kg}$ truck is traveling south with a speed of $30\,\mathrm{m/s}$. Taking north as the positive velocity direction, the total momentum of these two vehicles is

a. $+100,000\,\mathrm{kg\,m/s}$.

b. $-20,000\,\mathrm{kg\,m/s}$.

c. $-40,000\,\mathrm{kg\,m/s}$.

d. $+40,000\,\mathrm{kg\ m/s}$.

e. $+60,000\,\mathrm{kg\,m/s}$.

14 The MKS unit of force is the

a. $\mathrm{m/s^2}$.

b. pound.

c. newton.

d. kilogram.

15 When a car is making a turn, what is usually called the "cornering force" is actually the force of friction between the tires and the pavement. When a car goes into a skid, the tires begin sliding sideways over the pavement. When the skid begins, you expect the cornering force to

a. decrease.

b. stay the same.

c. increase.

16 Which of the following answers is closest to the weight (on the Earth's surface) of a woman whose mass is $50\,\mathrm{kg}$?

a. $50\,\mathrm{lb}$.

b. $5000\,\mathrm{N}$.

c. $5\,\mathrm{N}$.

d. $500\,\mathrm{N}$.

e. $50\,\mathrm{N}$.

17 An object is suspended a certain distance above the ground. If the distance is tripled, the gravitational potential energy of the object (relative to the ground) increases by a factor of

a. 2.

b. 27.

c. 3.

d. 4.

e. 9.

18 The chemical potential energy of 0.1kg of gasoline is higher than the carbon dioxide and water that result from burning it by roughly 4,000,000 joules. If you burn 0.1kg of gasoline in a 2000kg automobile and drive up a long hill, what is the absolute maximum increase in vertical distance that you can achieve?

a. 2500m.

b. 200m.

c. $4,000,000$m.

d. 2000m.

19 How much elastic potential energy is stored in a wall if leaning on it with an average force of 100N causes it to bow inward by one millimeter (0.001 meters).

a. 0.1J.

b. 0.001J.

c. 1J.

d. 100J.

20 A man is trying to push a railroad car along a level track. He is able to exert a horizontal force of about 1000N in the forward direction and the friction force is 200N (in the backward direction of course). The total force on the railroad car is

a. 800N forward.

b. 1000N forward.

c. 200N backward.

d. 1200N forward.

e. 1000N backward.

21 A horse is pulling a cart. The work that the horse does on the cart is actually done by the force that

a. the horse exerts on the cart.

b. the ground exerts on the cart.

c. the horse exerts against the ground.

d. the ground exerts on the horse.

e. the cart exerts on the horse.

22 Suppose that the weight of a block is 10N. How much work does the force of gravity do on the block when the block moves a distance of 2 meters along a level surface?

a. 0J.

b. 40J.

c. 10J.

d. 200J.

23 Suppose that you climb a flight of stairs while carrying a pail that weighs 100N. If the top of the stairs is 3 meters higher than the bottom, how much work has been done by the force that you exert on the pail?

a. -300Nm.

b. -100Nm.

c. 300Nm.

d. 100Nm.

e. It depends on the length of the stairs.

24 If the force on an object doubles while the object moves a given distance, the work that the force does on the object goes up by a factor of

a. 3.

b. 4.

c. 27.

d. 9.

e. 2.

25 If two objects are subjected to the same interactions (other than gravity), one expects that the object with smaller mass will accelerate

a. more than the other object.

b. less than the other object.

c. the same as the other object.

26 Suppose that you slowly lower a 10kg pail of water into a well from ground level to a distance of 1.5 meters below the ground. How much does the potential energy of the pail change?

a. increases by 150J.

b. increases by 100J.

c. decreases by 150J.

d. decreases by 100J.

Answer Key: Fall 2007 PHX2M

1 Choice a. (the laws of physics are the same in all inertial reference frames.)

2 Choice b. (The force that you exert on the chair and the force that the chair exerts on you.)

3 Choice d. (A rocket rising at a constant rate.)

4 Choice e. ($1,000,000\,\mathrm{N}$.)

5 Choice d. (sideways at $100\mathrm{m/s}^2$.)

6 Choice b. (moving objects keep moving unless something stops them.)

7 Choice b. (An object's resistance to acceleration depends only on the object and not at all on its surroundings.)

8 Choice d. (of zero.)

9 Choice d. (the ground.)

10 Choice e. (300,000 N.)

11 Choice a. (joule.)

12 Choice d. ($3\frac{1}{3}\,\mathrm{N}$.)

13 Choice b. ($-20,000\,\mathrm{kg\,m/s}$.)

14 Choice c. (newton.)

15 Choice a. (decrease.)

16 Choice d. (500 N.)

17 Choice c. (3.)

18 Choice b. (200m.)

19 Choice a. (0.1J.)

20 Choice a. (800N forward.)

21 Choice a. (the horse exerts on the cart.)

22 Choice a. (0J.)

23 Choice c. (300Nm.)

24 Choice e. (2.)

25 Choice a. (more than the other object.)

26 Choice c. (decreases by 150J.)

Solutions

1 Module 014 The Law of Inertia: Question 3.2
2 Module 018 Action and Reaction: Question 1.2
3 Module 016 The Law of Force and Mass: Question 4.1
4 Module 018 Action and Reaction: Question 4.2
5 Module 016 The Law of Force and Mass: Question 2.2
6 Module 014 The Law of Inertia: Question 1.3
7 Module 015 Mass, Measure of Inertia: Question 2.2
8 Module 017 Some Forces: Question 3.4
9 Module 018 Action and Reaction: Question 2.1
10 Module 016 The Law of Force and Mass: Question 5.3
11 Module 019 Work: Question 5.2
12 Module 018 Action and Reaction: Question 3.2
13 Module 018 Action and Reaction: Question 5.5
14 Module 016 The Law of Force and Mass: Question 1.1
15 Module 017 Some Forces: Question 2.4
16 Module 017 Some Forces: Question 1.1
17 Module 020 Potential Energy: Question 2.2
18 Module 020 Potential Energy: Question 5.1
19 Module 020 Potential Energy: Question 4.1
20 Module 016 The Law of Force and Mass: Question 3.3
21 Module 020 Potential Energy: Question 1.2
22 Module 019 Work: Question 4.2
23 Module 019 Work: Question 1.1
24 Module 019 Work: Question 2.2
25 Module 015 Mass, Measure of Inertia: Question 1.3
26 Module 020 Potential Energy: Question 3.1