1 In which of the following situations is your body closest to being in equilibrium?

a. Running at constant speed in a circle.

b. While jumping straight up.

c. While hitting a stone wall.

d. Running at constant speed in a straight line.

e. At the highest point of a vertical hop.

2 Suppose that it takes an average force of 2000 Newtons to draw a catapult back by two meters. How much potential energy is stored in the drawn catapult?

a. 2000J.

b. 200J.

c. 0J.

d. 4000J.

e. 400J.

3 A man is trying to push a railroad car along a level track. He is able to exert a horizontal force of about 1000N and the friction force is negligible. If the mass of the railroad car is 100 metric tons or $100,000$kg, it will accelerate along the track at

a. 0.009m/s^2.

b. 90m/s^2.

c. 100m/s^2.

d. 0m/s^2.

e. 0.01m/s^2.

4 Anti-lock brakes on a car are designed to make it impossible to apply the brakes so strongly that the car wheels stop turning and simply drag on the pavement. This system obviously helps to keep the car under control during a panic stop. Which of the following statements about stopping distance would you expect to be true?

a. The system can decrease stopping distance by preventing sliding.

b. The system always increases stopping distance because it limits how strongly the brakes can be applied.

c. The system has no effect on stopping distance.

5 A horse is pulling a cart, causing it to accelerate. The forces that act on the horse (which is also accelerating of course) are:

a. The inertial force on the horse, the force of the ground on the horse's hooves, and the force exerted by the horse's hooves.

b. The force exerted by the horse's hooves and the force exerted by the harness that connects the horse to the cart.

c. The force exerted by the ground on the horse's hooves and the force exerted by the harness that connects the horse to the cart.

d. The inertial force on the horse, and the force exerted by the harness that connects the horse to the cart.

6 Consider two stones, one with twice the mass of the other. If you throw each stone equally hard,

a. the more massive stone will accelerate more.

b. both stones will be accelerated to the same speed.

c. the less massive stone will accelerate more.

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

a. less than your weight.

b. equal to twice your weight.

c. of zero.

d. equal to your weight.

8 Suppose that you slowly lift a pail from the ground to a distance of 1.5 meters above the ground. The pail weighs 100N. How much work is done by the force that you exert on the pail?

a. -100Nm.

b. 150Nm.

c. 100Nm.

d. -150Nm.

9 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 100J.

b. increases by 150J.

c. decreases by 150J.

d. decreases by 100J.

10 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. 4.

b. 27.

c. 9.

d. 2.

e. 3.

11 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. 300,000 N.

b. 3,000,000 N.

c. 100 N.

d. 3000 N.

e. 300 N.

12 Which of the following answers is closest to the weight (on the Earth's surface) of a man whose mass is $100\,\mathrm{kg}$?

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

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

c. 10,000 N.

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

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

13 A spacecraft fires a short burst from one of its maneuvering rockets. The total mass of the spacecraft (including fuel) is $10,100\,\mathrm{kg}$ before the burst. The burst ejects $100\,\mathrm{kg}$ of reaction mass at an exhaust velocity of $2000\,\mathrm{m/s}$. The resulting change in the velocity of the spacecraft is

a. $20\ \mathrm{m/s}$.

b. $3\ \mathrm{m/s}$.

c. $2\,\mathrm{m/s}$.

d. $30\ \mathrm{m/s}$.

e. $200\ \mathrm{m/s}$.

14 A joule is equal to

a. 1N·s.

b. 1kg·m/s.

c. 1N.

d. 1N·m.

e. 1kg·m.

15 Suppose that you climb a flight of stairs while carrying a pail of water with a mass of 10kg. The work that you do on the pail is actually done by the

a. weight of the pail.

b. force of your hand on the pail.

c. force of your feet on the stairs.

d. force of the pail on your hand.

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

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

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

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

17 The statement that all of the laws of physics are the same in all inertial reference frames is called

a. the principle of relativity.

b. the principle of equivalence.

c. the anthropic principle.

d. the universality principle.

e. Newton's first law of motion.

18 A snow-blower shoots snow at the rate of $0.1\,\mathrm{kg/s}$ and an initial velocity of $20\,\mathrm{m/s}$. The resulting force that pushes back on the blower is

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

b. $200\,\mathrm{N}$.

c. $0.1\,\mathrm{N}$.

d. $0.005\,\mathrm{N}$.

e. $2\,\mathrm{N}$.

19 Bill and Betsy each carry identical pails of water from the ground to the second floor of a house. Betsy carries her pail into the house and up the stairs. Bill, on the other hand, puts a ladder up against the house and climbs to the second floor while holding the pail in his teeth. Compare the work done by the upward force that each exerts on his or her pail.

a. Betsy does more work than Bill.

b. Both do the same amount of work.

c. Bill does more work than Betsy.

d. The comparison cannot be made from the information given.

20 Suppose that the weight of a block is $10\mathrm{N}$. 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. $10\mathrm{J}$.

b. $0\mathrm{J}$.

c. $40\mathrm{J}$.

d. $200\mathrm{J}$.

21 In the MKS system of units, the kilogram is the unit of

a. force.

b. mass.

c. velocity.

d. momentum.

e. acceleration.

22 In Newton's second law of motion, $F = ma$, which of the following quantities depends only on the moving object and not on the object's surroundings or the way that it is moving?

a. a.

b. F.

c. m.

d. m/a.

e. a/m.

23 A rocket with a weight of $20,000$N is pointed straight up and fires its engines with a thrust of $200,000$N. The total force on this rocket is

a. $180,000$N upward.

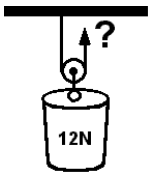
b. $200,000$N upward.

c. $220,000$N upward.

d. $180,000$N downward.

e. $20,000$N downward.

24 A twelve 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. $6\,\mathrm{N}$.

b. $3\,\mathrm{N}$.

c. $24\,\mathrm{N}$.

d. $4\,\mathrm{N}$.

e. $12\,\mathrm{N}$.

25 The chemical potential energy of 1kg of gasoline is higher than the carbon dioxide and water that result from burning it by roughly 40,000,000 joules. If your 2000kg car converts 25% of this energy into mechanical energy, how much gasoline would you need to climb a 50m tall hill?

a. 1kg.

b. 0.025kg.

c. 0.1kg.

d. 0.25kg.

e. 0.01kg.

26 Newton's First Law, the Law of Inertia

a. is just a special case of his second law.

b. is unrelated to Newton's other laws.

c. defines the reference frame for the other laws.

Useful Formulas

$p = mv$ $W = F_d d = F d_F$ $F = ma$

$W = mg$ P.E. $= mgh$ $v = at$

Answer Key: Spring 2004 Exam No. 2 Preview 1

1 Choice d. (Running at constant speed in a straight line.)

2 Choice d. (4000J.)

3 Choice e. (0.01m/s^2.)

4 Choice a. (The system can decrease stopping distance by preventing sliding.)

5 Choice c. (The force exerted by the ground on the horse's hooves and the force exerted by the harness that connects the horse to the cart.)

6 Choice c. (the less massive stone will accelerate more.)

7 Choice b. (equal to twice your weight.)

8 Choice b. (150Nm.)

9 Choice c. (decreases by 150J.)

10 Choice e. (3.)

11 Choice a. (300,000 N.)

12 Choice e. (1000 N.)

13 Choice a. (20 m/s.)

14 Choice d. (1N·m.)

15 Choice b. (force of your hand on the pail.)

16 Choice a. (The force that you exert on the chair and the force that the chair exerts on you.)

17 Choice a. (the principle of relativity.)

18 Choice e. (2 N.)

19 Choice b. (Both do the same amount of work.)

20 Choice b. (0J.)

21 Choice b. (mass.)

22 Choice c. (m.)

23 Choice a. (180, 000N upward.)

24 Choice a. (6 N.)

25 Choice c. (0.1kg.)

26 Choice c. (defines the reference frame for the other laws.)

Where the questions came from

1 Module 016 The Law of Force and Mass: Question 4.2
2 Module 020 Potential Energy: Question 4.3
3 Module 016 The Law of Force and Mass: Question 2.3
4 Module 017 Some Forces: Question 2.3
5 Module 018 Action and Reaction: Question 2.2
6 Module 015 Mass, Measure of Inertia: Question 1.1
7 Module 017 Some Forces: Question 3.2
8 Module 019 Work: Question 2.1
9 Module 020 Potential Energy: Question 3.1
10 Module 020 Potential Energy: Question 2.2
11 Module 016 The Law of Force and Mass: Question 5.3
12 Module 017 Some Forces: Question 1.3
13 Module 018 Action and Reaction: Question 5.4
14 Module 019 Work: Question 5.4
15 Module 020 Potential Energy: Question 1.1
16 Module 018 Action and Reaction: Question 1.2
17 Module 014 The Law of Inertia: Question 3.3
18 Module 018 Action and Reaction: Question 4.3
19 Module 019 Work: Question 1.4
20 Module 019 Work: Question 4.2
21 Module 015 Mass, Measure of Inertia: Question 3.2
22 Module 015 Mass, Measure of Inertia: Question 2.3
23 Module 016 The Law of Force and Mass: Question 3.2
24 Module 018 Action and Reaction: Question 3.3
25 Module 020 Potential Energy: Question 5.3
26 Module 014 The Law of Inertia: Question 1.1