1 An inertial reference frame is defined to be one in which

a. the reference points are all moving at uniform velocity.

b. every force gives rise to an equal and opposite reaction force.

c. objects show resistance to acceleration.

d. non-interacting objects have zero acceleration.

2 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. $10,000\,\mathrm{N}$.

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

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

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

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

3 At the surface of the earth, a 2kg mass weighs approximately

a. $30\,\mathrm{N}$.

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

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

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

e. $10\,\mathrm{lb}$.

4 Two men carry identical packages from the front lawn of a building to the building's first floor that is 1 meter higher than the front lawn. Fred walks up the stairs. David pushes his wheelchair up the handicapped access ramp that is five times as long as the stairs. If the upward force that Fred exerts on his package does 30Nm of work, how much work does the upward force that David exerts on his package do?

a. 30Nm.

b. 6Nm.

c. 15Nm.

d. 150Nm.

e. cannot be determined from the information given.

5 A rocket shoots 200 kg/s of exhaust out of its engine at an exhaust velocity of 2000 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. $400\,\mathrm{N}$.

b. 4,000,000 N.

c. 400,000 N.

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

e. $2000\,\mathrm{N}$.

6 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. stay the same.

b. increase.

c. decrease.

7 In which of the following situations would an automobile be in equilibrium?

a. Accelerating away from a stop light.

b. Moving at constant speed over the top of a hill.

c. Moving at constant speed in a circle.

d. Accelerating down a long straight incline.

e. Moving at constant speed down a long straight incline.

8 Another name for the unit Nm is the

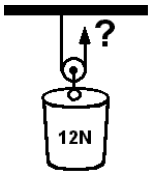
a. joule.

b. newton.

c. kilogram.

d. watt.

9 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. $12\,\mathrm{N}$.

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

10 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. $200\ \mathrm{m/s}$.

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

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

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

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

11 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. 100m/s^2.

b. 0.009m/s^2.

c. 90m/s^2.

d. 0.01m/s^2.

e. 0m/s^2.

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

d. all reference frames are the same.

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

a. equal to twice your weight.

b. less than your weight.

c. equal to your weight.

d. of zero.

14 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. decreases by 100J.

b. decreases by 150J.

c. increases by 100J.

d. increases by 150J.

15 Suppose that you climb a flight of stairs while carrying a pail of water with a mass of 10kg. If the top of the stairs is 3 meters higher than the bottom, the potential energy of the pail increases by

a. 30J.

b. 100J.

c. 300J.

d. 10J.

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

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

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

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

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

a. less than the other object.

b. the same as the other object.

c. more than the other object.

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

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

19 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 floor exerts on the chair.

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 chair exerts on you.

20 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. 100J.

d. 1J.

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 cart exerts on the horse.

b. the ground exerts on the cart.

c. the ground exerts on the horse.

d. the horse exerts against the ground.

e. the horse exerts on the cart.

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

a. 150Nm.

b. -150Nm.

c. -100Nm.

d. 100Nm.

23 The newton is the MKS unit of

a. time.

b. acceleration.

c. force.

d. mass.

e. momentum.

24 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. 0.01kg.

c. 0.1kg.

d. 0.025kg.

e. 0.25kg.

25 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. $220,000$N upward.

b. $20,000$N downward.

c. $180,000$N downward.

d. $180,000$N upward.

e. $200,000$N upward.

26 You walk a distance of 1000 meters (one kilometer) along a level road while carrying a baby in a back-pack. The baby weighs 100 newtons (about 22 pounds), so you must exert a constant upward force of 100 newtons in order to carry it. How much work does this upward force do on the baby?

a. 100Nm.

b. 1000Nm.

c. 0Nm.

d. $100,000$Nm.

Useful Formulas

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

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

Answer Key: Exam No.2 Preview 2

1 Choice d. (non-interacting objects have zero acceleration.)

2 Choice d. ($1,000,000$ N.)

3 Choice d. (20 N.)

4 Choice a. (30Nm.)

5 Choice c. (400,000 N.)

6 Choice c. (decrease.)

7 Choice e. (Moving at constant speed down a long straight incline.)

8 Choice a. (joule.)

9 Choice a. (6 N.)

10 Choice e. (20 m/s.)

11 Choice d. (0.01m/s^2.)

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

13 Choice c. (equal to your weight.)

14 Choice b. (decreases by 150J.)

15 Choice c. (300J.)

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

17 Choice a. (less than the other object.)

18 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.)

19 Choice d. (The force that you exert on the chair and the force that the chair exerts on you.)

20 Choice a. (0.1J.)

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

22 Choice b. (-150Nm.)

23 Choice c. (force.)

24 Choice c. (0.1kg.)

25 Choice d. ($180,000$N upward.)

26 Choice c. (0Nm.)

Where the questions came from

1 Module 014 The Law of Inertia: Question 2.2
2 Module 018 Action and Reaction: Question 4.2
3 Module 017 Some Forces: Question 1.2
4 Module 019 Work: Question 1.3
5 Module 016 The Law of Force and Mass: Question 5.4
6 Module 017 Some Forces: Question 2.4
7 Module 016 The Law of Force and Mass: Question 4.3
8 Module 019 Work: Question 5.2
9 Module 018 Action and Reaction: Question 3.3
10 Module 018 Action and Reaction: Question 5.4
11 Module 016 The Law of Force and Mass: Question 2.3
12 Module 014 The Law of Inertia: Question 3.2
13 Module 017 Some Forces: Question 3.1
14 Module 020 Potential Energy: Question 3.1
15 Module 020 Potential Energy: Question 2.1
16 Module 015 Mass, Measure of Inertia: Question 2.2
17 Module 015 Mass, Measure of Inertia: Question 1.2
18 Module 018 Action and Reaction: Question 2.2
19 Module 018 Action and Reaction: Question 1.2
20 Module 020 Potential Energy: Question 4.1
21 Module 020 Potential Energy: Question 1.2
22 Module 019 Work: Question 3.1
23 Module 016 The Law of Force and Mass: Question 1.2
24 Module 020 Potential Energy: Question 5.3
25 Module 016 The Law of Force and Mass: Question 3.2
26 Module 019 Work: Question 4.1