

Instructions: This test is divided into two parts. Part A is entitled short answer questions where you are to pick the best word, phrase or choice of answers which best answers or, in some cases, defines the statement. Part B is entitled longer answer questions. Make your answers clear and concise. If you need more room turn over the test paper and continue on the back, but please write "over" on the test. For problems, it is the procedure that will be checked, not only the answer so please try to make it clear. Be sure to include units in answering problems (such as we've done in class). For problems that include underlined precision digits, be sure to use the corresponding precision rule or significant figure rule, accordingly. Point weighing is indicated in parentheses. So for this, the first quiz of the fall poets' course, Good Luck!

Here are some recipes: $d = vt$ $v = at$ $d = \frac{1}{2}at^2$ $F = m\frac{v^2}{R}$ $F = ma$ $w = mg$

Use $g = 9.8 \text{ m/s}^2 = 32 \text{ ft/s}^2$ for the surface of the earth.

A. Short Answer Questions (1 Point each question except as marked. Questions 1 through 13 are multiple choice.)

b 1. Suppose that Andy rides on a merry-go-ride turning at a constant rate. In which direction does the net force on Andy point? (a) tangent to the circular path (b) toward the center (c) away from the center (d) down

b 2. A football quarterback throws a long pass toward the end zone. Assume that you can neglect the effects of air resistance. At the instant the ball reaches its highest point, what is the direction of the net force on the ball? (a) up (b) down (c) horizontal (d) the net force is zero

b 3. A baseball player throws a ball from left field toward home plate. Assume that you can neglect the effects of air resistance. At the instant the ball reaches its highest point, what is the direction of the balls acceleration? (a) up (b) down (c) horizontal (d) the acceleration is zero

C 4. We claimed that, if the air resistance could be neglected, all objects on the earth would fall at (a) the same constant speed (b) an increasing acceleration (c) the same constant acceleration (d) a decreasing acceleration

b 5. You are bouncing on a trampoline while holding a bowling ball. As your feet leave the trampoline, you let go of the bowling ball. When you reach your maximum height, the bowling ball is (a) above you (b) beside you (c) below you

a 6. What is the net force on a 900 kg airplane flying with a constant altitude and velocity of 180 km/H north? (a) zero (b) 180 N (c) 900 N (d) 162,000 N

b 7. If a race car is traveling around a circular track at a constant speed of 100 mph, we know that the car experiences (a) no net force (b) a centripetal force (c) a centrifugal force (d) a net force in the forward direction

a 8. During a physics experiment, a fan is used to apply a push to a cart on a horizontal track. A student would like the net force on the cart to be 12 N to the right. The student knows that the friction force on the cart by the track will be 3 N to the left. The fan should exert a force of (a) 15 N to the right (b) 15 N to the left (c) 9 N to the right (d) 9 N to the left (e) none of these

d 9. What net force is needed to accelerate a 60 kg ics skater at 2 m/s^2 ? (a) zero (b) 30 N (c) 60 N (d) 120 N

d 10. Which of the following is not a vector quantity? (a) force (b) acceleration (c) weight (d) mass

a 11. An astronaut on a strange planet has a mass of 80 kg and a weight of 240 N. What is the value of the acceleration due to gravity on this planet? (a) 3 m/s^2 (b) 8 m/s^2 (c) 10 m/s^2 (d) $1/3 \text{ m/s}^2$ $w = mg$

C 12. You leap from a bridge with a bungee cord tied around your ankles. As you approach the river below, the bungee cord begins to stretch and you begin to slow down. The force of the cord on your ankles to slow you is ? your weight? Choose from (a) less than (b) equal to (c) greater than $g = \frac{w}{m} = \frac{240 \text{ kg} \cdot \text{m/s}^2}{80 \text{ kg}} = 3 \frac{\text{m}}{\text{s}^2}$

d 13. by what factor does the centripetal acceleration change if a car goes around a corner twice as fast? (a) 0.5 (b) It stays the same (c) 2 (d) 4

$$a_1 = \frac{v_1^2}{R_1} \quad a_2 = \frac{v_2^2}{R_1} = \frac{(2v_1)^2}{R_1} = \frac{4v_1^2}{R_1} = 4a_1$$

(or cycles)

$1.61 \frac{s}{\text{cycle}}$ 14. (2)

A long pendulum was observed to make 20.5 complete swings in 33 s ~~seconds~~. It's period is ?

$T = \frac{t}{\text{cycles}} = \frac{33s}{20.5 \text{ cycles}} = 1.61 \frac{s}{\text{cycles}}$

\sqrt{L} 15. (1)

The goal of the pendulum lab was to determine whether or not the period of a pendulum was or was not proportional to ?

instrumental 16. (2)
inherent

Errors due to the precision of your measuring instruments are called ? errors, while errors due to problems in the experiment itself are called ? errors.

Newton 17. (1)

The scientist who developed Calculus and three laws of motion is ?

$220,000 \text{ cm}^3 = 2.2 \times 10^5 \text{ cm}^3$ 18. (2)

REVIEW QUESTION: A box measuring 2.5 m by .35 m by .25 m contains ? cm^3 .

Volume = $(250 \text{ cm})(35 \text{ cm})(25 \text{ cm}) = 220,000 \text{ cm}^3$

ellipse 19. (1)

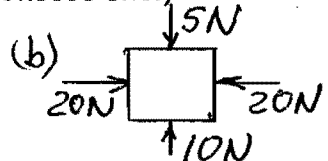
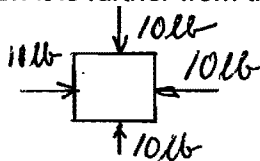
Kepler claimed that the planets in our solar system move in a geometric orbit called ?

a 20. (1)

When a comet is closer to the sun, its speed (a) is faster (b) is slower or (c) does not change from what it is when it is further from the sun. (Choose one.)

0 lb (a) 21. (2)
5 N (b)

each of the following:



22. (2) If the net force acting on a moving object is zero, describe the motion of the object at later times?

An object in motion will continue in motion (a) at constant speed and (b) in a straight line (Thanks to Newton's 1st Law).

23. (1) For a particular mass, if the net force acting on it is suddenly doubled, what can be said about its acceleration? $a \propto F$ Hence acceleration is doubled

Weight 24. (1)

The force exerted by the earth on our body is called ?

1568 N 25. (2)
160 kg

The weight of a 160 kg object is ? while its mass is ?. $W = mg = (160 \text{ kg})(9.8 \frac{m}{s^2}) = 1568 \text{ N}$

2 slugs 26. (2)
64 lb

The mass of a 64 lb object is ? and its weight is ?. $m = \frac{W}{g} = \frac{64 \text{ lb}}{32 \frac{ft}{s^2}} = 2 \text{ slugs}$

a 27. (1)

A lunar month is about 28 days. If the moon were closer to the earth than what it presently is, the lunar month would be (a) less than 28 days, (b) unchanged, (c) greater than 28 days. (Choose one.)
 ← faster! greater orbital velocity
 OR $T^2 \propto R^3$

Greeks 28. (1)

"A more massive object seeks down more than a lighter object" is a statement that would be attributed most likely to (Greeks, Galileo, Newton). List all that apply.

91 km 29. (2)

REVIEW QUESTION: If an object travels 3000 ft, the distance traveled in km is ?. (Note: 5280 ft = 1 mi and 1.6 km = 1 mi.) $3000 \text{ ft} = \left(\frac{3000 \text{ ft}}{5280 \text{ ft}}\right) \left(\frac{1 \text{ mi}}{1 \text{ mi}}\right) \left(\frac{1.6 \text{ km}}{1 \text{ mi}}\right) = 91 \text{ km}$

force exerted by person on earth 30. (1)

The reaction force to the weight of a person is ?. (Hint: The weight force is a force exerted by ? on ?.)
 earth person.

no 31. (1)

REVIEW QUESTION: If the speed of an object is constant, must the velocity also be constant? (yes, no) (Choose one.)

direction can change!

32. (10) REVIEW QUESTION PLUS: Choose from the physical quantities which we have discussed - length, area, volume, time, mass, force, velocity (or speed), acceleration, period - to identify the following quantities taken from problems.

- | | | |
|--|--|---|
| <u>mass</u> a) 25.2 slugs | <u>mass</u> f) 3.74 lb sec ² /ft = slug | <u>area</u> l) 23.4 m ² |
| <u>volume</u> b) 21.3 cubic ft | <u>length</u> g) 1.43 mi | <u>mass</u> m) 23.2 kg |
| <u>acceleration</u> c) 7.48 m/sec ² | <u>speed</u> h) 1.85 m/sec | <u>force</u> n) 78.3 N |
| <u>time</u> d) 4.92 sec | <u>force</u> i) 3.54 lb | <u>time</u> o) 33.2 H |
| <u>period</u> e) 5 sec/cycle | <u>speed</u> j) 5.3 in/sec | <u>force</u> p) 7.1 kg m/sec ² = N |

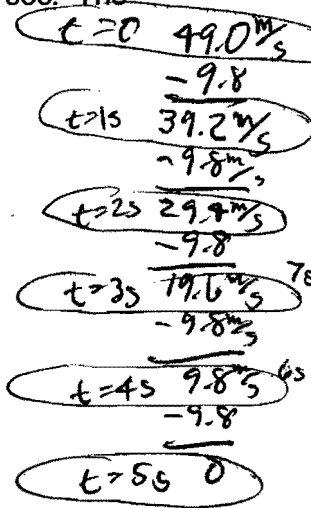
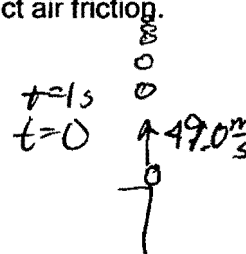
B. Longer Answer Questions

1. (4) State Newton's Third Law and make up an example. For every action force, there exists an equal but oppositely directed reaction force. These forces always come in pairs & always act on two different objects. Example: BOOK on TABLE. For BOOK, $F_{\text{on BOOK}}$ (up) Force exerted by TABLE on BOOK. For TABLE, $F_{\text{on TABLE}}$ (down) Force exerted by BOOK on TABLE.

2. An object is given an initial velocity of 49.0 m per sec straight up into the air at $t = 0$ sec. The acceleration due to gravity is 32 ft/sec² or 9.8 m/sec². Neglect air friction.

(a) Find its velocity at the following times:

- 39.2 $\frac{m}{s}$ \uparrow (1)(i) $t = 1$ sec
- 19.6 $\frac{m}{s}$ \uparrow (1)(ii) $t = 3$ sec
- 0 (1)(iii) $t = 5$ sec
- 19.6 $\frac{m}{s}$ \downarrow (1)(iv) $t = 7$ sec



(b) (1) How long does the object take to return to the thrower's hand?

$5s + 5s = 10s$

(c) (2) How high did the object go?

From top (velocity = 0) back down to hand it takes 5s to travel AND starts from rest! Hence $d = \frac{1}{2}at^2 = \frac{1}{2}(9.8 \frac{m}{s^2})(5s)(5s) = 122.5m$

(d) (1) The acceleration at the top of the path is what? $g = 9.8 \frac{m}{s^2} \downarrow$

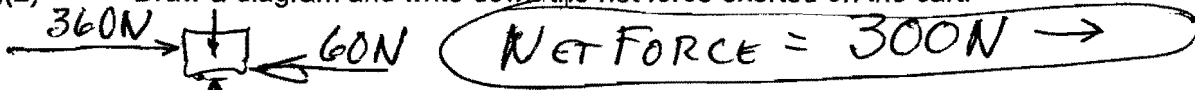
3. (4) A net force of 75 N accelerates an object at 3 m/sec². (a) What is the mass of the object? (b) What is the weight of the object?

(a) $F = ma$ or $m = \frac{F}{a} = \frac{75 \text{ kg} \frac{m}{s^2}}{3 \frac{m}{s^2}} = 25 \text{ kg}$

(b) $w = mg = (25 \text{ kg})(9.8 \frac{m}{s^2}) = 245 \text{ N}$

4. REVIEW QUESTION: A 75 kg woman exerts a force of 360 N to a full grocery cart whose mass is 100 kg. (This is one strong woman!) There is a frictional force of 60 N acting in the opposite direction.

(a)(2) Draw a diagram and write down the net force exerted on the cart.



(b)(2) What is the acceleration of the cart? $m_{\text{CART}} = 100\text{kg}$

$$F=ma \quad a = \frac{F}{m} = \frac{300\text{ kg m/s}^2}{100\text{kg}} = 3\text{ m/s}^2$$

(b)(1) How fast will the cart be moving after 3 sec if it starts from rest?

$$v=at = \left(3\frac{\text{m}}{\text{s}}\right)(3\text{s}) = 9\frac{\text{m}}{\text{s}}$$

(c)(1) How far will the cart move after 3 sec again starting from rest?

$$d = \frac{1}{2}at^2 = (0.5)\left(3\frac{\text{m}}{\text{s}^2}\right)(3\text{s})(3\text{s}) = 13.5\text{m}$$

5. (6) (a) (3) Discuss the force known as friction (Include the three "types" of friction discussed in class.), and (b) (2) mention three major methods of reducing friction as discussed in class. Use diagrams where helpful.

- (a) Friction is a force that always opposes the direction of motion of an object. There is (1) starting (static) friction (2) moving (kinetic) friction and (3) rolling friction (smallest)
- (b) Friction may be reduced by (1) Lubrication (oil or air cushion) (2) Use of Roller Bearings (3) Streamlining (design of an object in order to minimize friction).

6. For people, discuss their contribution; for terms, define and briefly discuss:

(2) terminal velocity is the constant velocity of a falling object that results when the downward weight force equals the upward friction force. The net force = 0 & object falls at constant velocity (from Newton's First Law).

(2) Ptolemy was an ancient astronomer (~150AD) who devised a brilliant (albeit complicated) model that placed the earth at the center of the universe. It could predict eclipses (!) & won the favor of the Catholic Church (a tenet).

(2) Copernicus was an astronomer (~1500AD) who devised a much simpler model of our solar system that placed our sun at the center. It had equal (or better) predictability than Ptolemy, but it initially was NOT accepted by the Church.

(2) Tycho Brahe was an astronomer (~1500AD) who took some of the greatest astronomical data of the movement of our planets. This data was used by Kepler in formulating his 3 LAWS!