FPS – Unit 3 Review – Chapter 12

Name_____ Period_____

Conceptual Understanding

1. What is a force? What is it measured in?

   Force is a push or pull- measured in Newtons

2. Define the units that comprise the "Newton".

   1 N = 1 kg m /s^2

3. How do we represent forces? How do you know it is a vector?

   Using arrows – shows magnitude and direction

4. Define balanced and unbalanced forces.

   Balanced – net force is zero, does not cause change in motion

   Unbalanced – net force is NOT zero, causes acceleration (or change in motion)

5. What is the net force and what does it tell you about the motion?

   Overall force acting on the object (or what's "left over" after force "cancel out")—tells you the direction/magnitude of motion

6. What is friction?

   Force that opposes motion – 4 types all in opposite direction of the applied force

7. List and define the 4 types of friction.

   Static (nonmoving objects), Sliding (object sliding on a surface eg.: ice skating, less than static), rolling (circular object rolling on a surface eg.: bowling or ball bearings, least amount of force than other frictions), fluid (air resistance or in other fluids)

8. Which type of friction is the smallest force?

   Rolling

9. How does gravity act on objects?

   Attractive force, weakest of the universal forces, pulls us down toward the core, field force, accelerates at 9.8 m/s^2 for all objects, affects the weight, Newtonian terms all objects with mass attracts all other objects with mass

10. Explain terminal velocity. Is it a balanced or unbalanced force?

    Balanced – moment of free-falling object when the air resistance is equal to the gravity force and travels at constant velocity

11. Explain projectile motion.

Falling object follows a curved path due to gravity, air resistance, and the initial forward velocity.

12. What are the four common forces we consider on a free-body diagram? Define.

Gravity – always present, pulls down

Normal – when object touching a surface, frequently shown and pushing up on the object touching the ground or surface

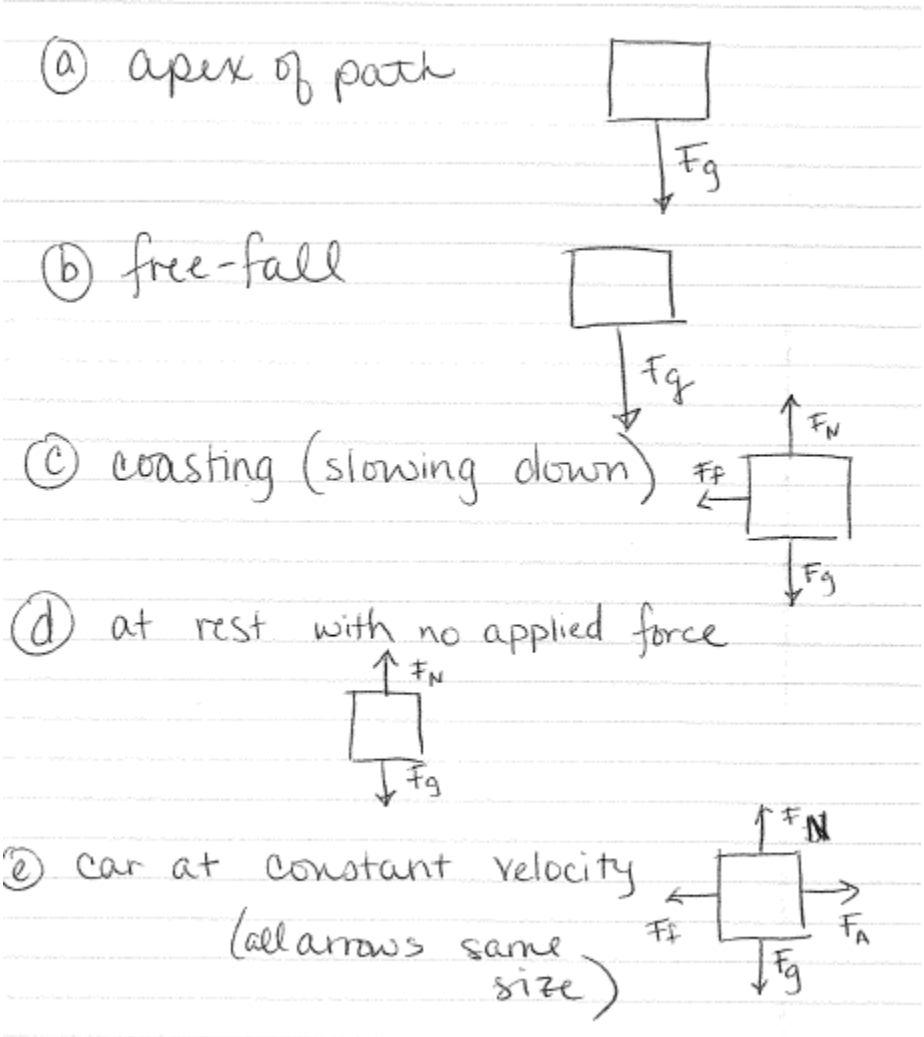
Friction – force opposing applied

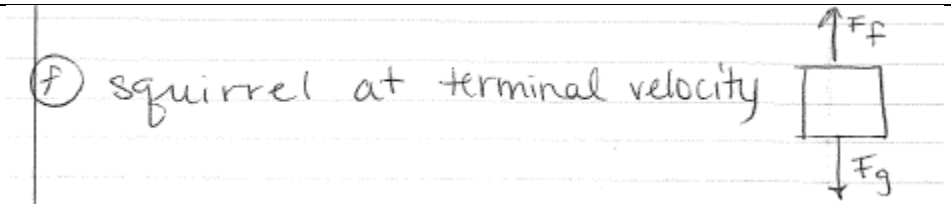
Applied – push or pull or "action"

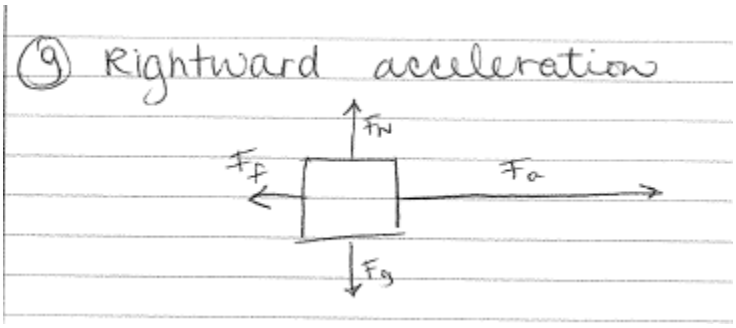
13. Why do we call free-body diagrams "free-body"?

Consider object without its surroundings

14. What does a free-body diagram look like for: (a) apex of path (b) free-fall (c) coasting (d) at rest with no applied force (e) car at constant velocity (f) squirrel at terminal velocity (g) rightward acceleration.







15. Define Newton's 3 Laws of Motion.

    1 – Law of inertia, objects in motion/rest stay in motion/rest unless acted on by outside unbalanced force

    2 – F=ma ; need a force to move a mass

    3 – For every action there is an equal and opposite reaction; action-reaction pairs

16. How is inertia related to mass?

    More mass= more inertia; directly related as a property of mass and a mass's resistance of change to its motion

17. Give the formula for Newton's second law.

    F=ma

18. Give an example of an action-reaction pair.

    You kick a ball with 10 N, ball pushes back with equal and opposite force (-10N)

19. How are weight and mass different?

    Weight changes based on acceleration due to gravity (it is the product of the object's mass and the gravity) and measured in Newtons; Mass is the amount of matter/inertia of an object measured in kg and does NOT change

20. What is momentum and how do we calculate it?

    Momentum is the product of mass and velocity of an object and is directly related to the force required to stop an object's movement. Calculate: momentum = mass x velocity (unit is kg m/s)

21. What is different between field and contact forces?

    Field – does NOT require connection

Contact – requires direct connection (eg.: normal, friction, applied)

22. List and define the universal forces.

Electromagnetic – electric and magnetic forces which can both attract and repel. Example: socks sticking together in drier shows electric forces.

Nuclear – strong and weak – hold the nucleus together and other particles. Strong nuclear are responsible for the nucleus structure

Gravitation – weakest universal force that attracts all objects with mass to all other objects with mass

23. Which forces can attract and repel?

Electric and Magnetic

How does Newtonian thought consider gravitation?

Gravitation – weakest universal force that attracts all objects with mass to all other objects with mass

Applying Concepts

24. Two teams are playing tug of war. The rope is perfectly still. Describe the net force and what type of force is occuring.

Net force is zero BECAUSE no change in motion. Balanced.

25. You are ice skating, and then you go bowling. What types of friction are happening? Which scenario(s) has LESS friction?

Ice skating = sliding, bowling = rolling

Rolling is LESS frictional force

26. You then go skydiving. What forces are acting on you? What happens when you reach constant velocity during your fall?

Air resistance, gravity acting on your free-fall

At **terminal velocity** you reach constant velocity when the two forces are EQUAL

27. A projectile is shot from a cannon. What type of path does it follow?

Curved path due to gravity, air resistance, and initial forward velocity

28. You release a cannonball as a projectile from a cannon and then drop one at the

same height at exactly the same moment. Which will hit the ground first? Why?

THEY WILL HIT AT THE SAME TIME

Acceleration due to gravity is the same for ALL OBJECTS

29. Three dogs pull a sled eastward with 5 newtons of force each. What is the net force?

3 x 5N = 15N eastward

30. You are pulling a toy away from your baby sister. She pulls with 0.5 newtons of force to the left and you pull with 6 newtons of force to the right. What is the net force?

-(0.5N) + (6N) = 5.5 N to the right (use negative/positive signs IF IT HELPS—if not just find the difference)

31. How will your mass change on the moon? How about your weight?

Mass with not change

Weight will decrease (1.6 m/s^2 acceleration due to gravity on the moon is much less than Earth's)

32. Which has more inertia: you or the Shaker Heights High School building? Why?

School building has more because it has WAY MORE mass! Will require much for force to move.

33. Two birds with the same mass are flying, the first at 2 m/s the second at 10 m/s. Which has more momentum? Why?

Second – highest velocity gives a larger momentum

34. An enormous truck is stationary while a tiny insect travels at 1 m/s. Which has more momentum? Why?

Insect does because truck has 0 m/s velocity – so 0 momentum

35. When you take your socks out of the dryer, two of them seem stuck together. Which of the universal forces are acting here?

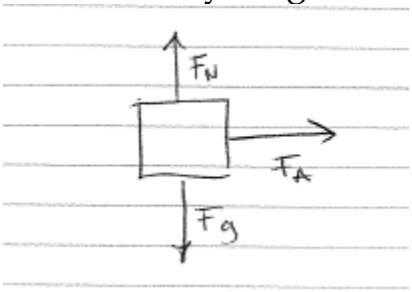
Electric forces!

36. A steel ball and a wooden ball are dropped from the same height same time. Which will reach terminal velocity first?

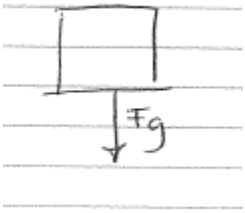
Wooden ball with reach first because the steel ball has a bigger weight so will require more speed to reach air resistance force that is equal to the weight.

Graphical and Mathematical Problems

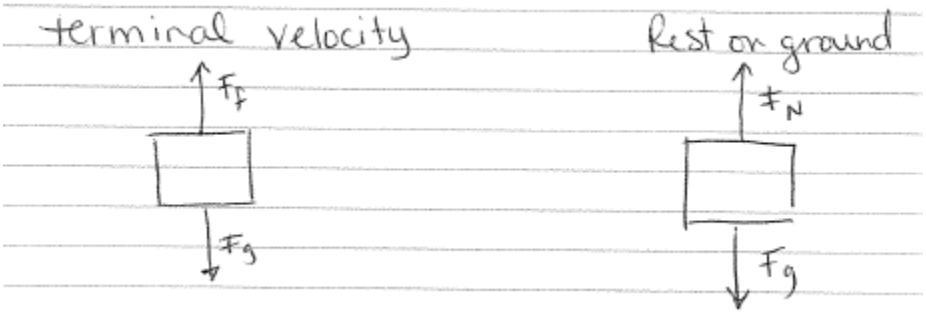
37. A penguin slides on his stomach down an icy hill. Ignore frictional forces. Draw the free-body diagram.



38. The penguin leaps out of the water. Draw the free-body diagram of the penguin the moment it is in the apex of its jump. (Not touching any other surfaces.)

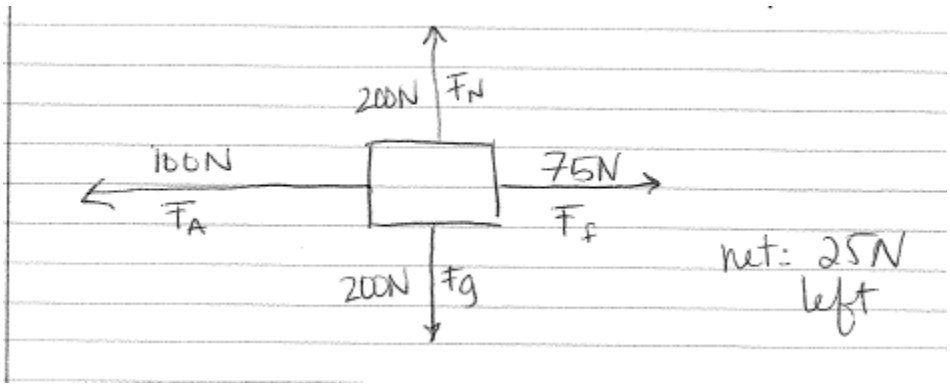


39. Draw a free-body diagram for an object at **terminal velocity** and another for an object at **rest on the ground**.



40. Draw a free-body diagram for a car accelerating to the left. Gravity pulls with a force of 200 N and the normal forces of the road push with 200 N as well. The car applies a force of 100 N to the right, while the rolling friction pushes back with 75

N. Label all the forces and find the net force's magnitude and direction.



41. An 11 kg bowling ball requires what force to accelerate down an alleyway at a rate of 4 m/s^2?

$F = ma = (11kg)(4 m/s^2) = 44N$

42. What is the mass of a free-falling rock if it produces a force of 247 N?

$m = \frac{F}{a} = \frac{247N}{9.8 m/s^2} = 25.2 kg$

43. What is the acceleration of a truck that has a mass of 2,800 kg and produces a force of 14,000 N?

$a = \frac{F}{m} = \frac{14,000N}{2,800kg} = 5\ m/s^2$

44. How fast will your car accelerate if it has a mass of 2000 kg and produces a force of 5000 N?

$a = \frac{F}{m} = \frac{5000N}{2000kg} = 2.5\ m/s^2$

45. What net force is required to accelerate a car at a rate of 2 m/s^2?

*Refer to previous question

$F = (2000kg)(2 m/s^2) = 4000N$

46. What is the weight of a 56 kg orangutan on Neptune (the acceleration due to

gravity on Neptune is 11.28 m/s^2)?

$W = mg = (56\,kg)(11.28\,m/s^2) = 631.68\,N$

47. What is the weight of an 80 kg man on the moon (1.6 m/s^2 is the acceleration due to gravity on the moon).

$W = mg = (80\,kg)(1.6\,m/s^2) = 128\,N$

48. What is the mass of an 80 kg man on the moon?

80 kg!! Mass doesn't change

49. What is the momentum of a 12,000 kg yacht parked stationary at the dock?

$p = mv = (12{,}000\,kg)(0\,m/s) = 0\,kgm/s$

50. What is the momentum of a 0.02kg insect travelling at 30 m/s?

$p = mv = (.02\,kg)(30\,m/s) = 0.60\,kgm/s$