Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Conceptual Physics Semester I and II Mixed Review #2

Multiple Choice
Identify the choice that best completes the statement or answers the question.

Show work to justify your answers!

____ 1. A table tennis ball moving forward with 5 units of momentum strikes and bounces backward off a heavy bowling ball that is initially at rest and free to move. The bowling ball is set in motion with a momentum of
a. 5 units.
b. not enough information.
c. less than 5 units.
d. more than 5 units.

____ 2. A ball is thrown straight up. At the top of its path its acceleration is
a. 0 m/s^2.
b. about 5 m/s^2.
c. about 10 m/s^2.
d. about 20 m/s^2.
e. about 50 m/s^2.

____ 3. Two people pull on a rope in a tug-of-war. Each pulls with 300 N of force. What is the tension in the rope?
a. 0 N
b. 300 N
c. 450 N
d. 600 N
e. none of the above

____ 4. Which of the following has the largest momentum?
a. A large truck parked in a parking lot
b. A tightrope walker crossing Niagara Falls
c. The science building at your school
d. A pickup truck traveling down the highway
e. A dog running down the street

____ 5. A scalar is a quantity that has
a. direction.
b. magnitude.
c. time.
d. color.

____ 6. At what part of a path does a projectile have minimum speed?
a. When it returns to the ground
b. Halfway to the top
c. At the top of its path
d. When it is thrown
e. There's not enough information to say.

____ 7. Which best approximates the resultant of a pair of 9-unit vectors at right angles to each other?
a. 9 units.
b. 18 units.
c. 13 units.
d. 0 units.

____ 8. A cyclist travels 14 meters in the first second of travel, 14 meters again during the second second of travel, and 14 meters again during the third second. Its acceleration is
a. 0 m/s^2.
b. 14 m/s^2.
c. 28 m/s^2.
d. 42 m/s^2.
e. none of the above

____ 9. A car starts from rest and after 7 seconds it is moving at 42 m/s. What is the car's average acceleration?
a. 0.17 m/s^2
b. 1.67 m/s^2
c. 6 m/s^2
d. 7 m/s^2
e. none of the above

____ 10. In the absence of air resistance, objects fall at constant
a. speed.
b. velocity.
c. acceleration.
d. distances each successive second.
e. all of the above

____ 11. Bronco the skydiver falls toward Earth. The attraction of Earth on Bronco pulls him down. The reaction to this force is
a. Bronco finally pushing against Earth's surface.
b. Bronco pulling up on Earth.
c. Earth's surface finally pushing against Bronco.
d. neither A, B, nor C

____ 12. Suppose you take a trip that covers 120 km and takes 2 hours to make. Your average speed is
a. 240 km/h.
b. 120 km/h.
c. 360 km/h.
d. 60 km/h.
e. 30 km/h.

____ 13. A freely falling object starts from rest. After falling for 1.5 seconds, it will have a speed of about
a. 7.5 m/s.
b. 15 m/s.
c. 30 m/s.
d. 60 m/s.
e. none of the above

____ 14. A 10-kg ball is thrown at 3 m/s. What is the ball's momentum?
a. 10 kg·m/s
b. 3 kg·m/s
c. 30 kg·m/s
d. 9 kg·m/s
e. none of the above

____ 15. A 3.0-kg ball has a momentum of 12.0 kg·m/s. What is the ball's speed?
a. 0.3 m/s
b. 4.0 m/s
c. 12.0 m/s
d. 36.0 m/s
e. none of the above

____ 16. Temperature is related mostly to the _____.
a. average molecular kinetic energy in a substance
b. total kinetic energy in something
c. average energy in a substance
d. total energy in something
e. average kinetic energy of an object

____ 17. Heat is measured in _____.
a. kilocalories
b. joules
c. calories
d. all of the above
e. none of the above

____ 18. When an iron ring is heated, the hole becomes _____.
a. larger
b. smaller
c. neither smaller nor larger

____ 19. During a very cold winter, water pipes sometimes burst. The reason for this is _____.
a. water expands when freezing
b. water contracts when freezing
c. the ground contracts when colder, pulling pipes apart
d. the thawing process releases pressure on the pipes
e. none of the above

____ 20. The lowest possible temperature in nature is
a. –273 degrees C.
b. 4 K.
c. 0 degrees C.

Problem

Show all equations used (with only variables), all work, and correct units.

21. What is the average momentum of a 50-kg speedskater who covers 100 m in 20 s?

22. A 10-kg cement block moving horizontally at 4 m/s plows into a bank of sand and comes to a stop in 2 s. What is the average impact force on the bank?

23. A 50-kg football player leaps through the air to collide with and tackle a 50-kg player heading toward him, also in the air. If the 50-kg player is heading to the right at 8 m/s and the 50-kg player is heading toward the left at 1 m/s, what is the speed and direction of the tangled players?

24. A 9-kg bowling ball moving at 4 m/s bounces off a spring at about the same speed that it had before bouncing. What is the change in momentum of the bowling ball?

25. A 45-kg girl and a 30-kg boy face each other on friction-free roller skates. The girl pushes the boy, who moves away at a speed of 3 m/s. What is the girl's speed?

26. Assume that a 5-kg ball moving at 7 m/s strikes a wall perpendicularly and rebounds elastically at the same speed. What is the amount of impulse given to the wall?

27. You sit at the outer rim of a Ferris wheel that rotates at 9 revolutions per minute (RPM). What would your rotational speed be if you were instead clinging to a position halfway from the center to the outer rim?

28. A vertical pole standing against a wall topples to the ground and the center of the pole has a speed of 7 m/s as it hits. With what speed does the far end of the pole hit the ground?

29. At the outer edge of a rotating space habitat, 200 m from its center, the rotational acceleration is *g*. What is the rotational acceleration at a distance of 100 m from the center of the habitat?

30. What amount of heat is required to raise the temperature of 50 grams of water by 20°C?

31. Suppose you apply a flame and heat one liter of water and raise its temperature by 15°C. If you instead transfer the same quantity of heat to 5 liters of water at the same temperature, what will be the temperature increase?

32. A 92-g iron bar at 150°C is placed in 200 g of water at 22°C. If the specific heat capacity of iron is 0.11 cal/g°C, to what final temperature will the iron bar cool?

33. At what temperature would the molecules of a gas have twice the average kinetic energy they have at a 38ºC room temperature?

34. There is a type of power plant, known as OTEC, that operates on the temperature difference between warm surface waters and cool deep waters. What is the Carnot efficiency of such a plant if the surface water is 22ºC and the deep water is 5ºC?

35. By what factor would your weight be multiplied if Earth were $\frac{1}{4}$ as massive and Earth's diameter remained unchanged?

36. A woman whose mass is 60 kg on Earth's surface is in a spacecraft at a height of twice Earth's radius (that is, 2 Earth radii) above Earth's surface. What is her mass (not weight) there?

37. A man whose mass is 60 kg is in a spacecraft at a height equal to Earth's diameter (not radius!) above Earth's surface. What is the gravitational force between him and Earth at this distance?

Conceptual Physics Semester I and II Mixed Review #2
Answer Section

MULTIPLE CHOICE

1. ANS: D PTS: 1 DIF: L2 OBJ: 8.5 Collisions
   STA: Ph.2.g KEY: momentum | motion BLM: application
2. ANS: C PTS: 1 DIF: L2 OBJ: 4.5 Free Fall: How Fast?
   STA: Ph.1.b | Ph.1.c | Ph.2.c KEY: acceleration BLM: comprehension
3. ANS: B PTS: 1 DIF: L2
   OBJ: 7.4 Action and Reaction on Different Masses STA: Ph.1.d
   KEY: force | newtons BLM: application
4. ANS: D PTS: 1 DIF: L2 OBJ: 8.1 Momentum
   STA: Ph.2.d KEY: momentum BLM: comprehension
5. ANS: B PTS: 1 DIF: L1 OBJ: 5.1 Vector and Scalar Quantities
   STA: Ph.1.j KEY: scalar | magnitude BLM: knowledge
6. ANS: C PTS: 1 DIF: L2 OBJ: 5.4 Projectile Motion
   STA: Ph.1.f KEY: projectile | speed BLM: comprehension
7. ANS: C PTS: 1 DIF: L2 OBJ: 5.2 Velocity Vectors
   STA: Ph.1.j KEY: resultant | vector BLM: application
8. ANS: A PTS: 1 DIF: L2 OBJ: 4.4 Acceleration
   STA: Ph.1.c KEY: acceleration BLM: application
9. ANS: C PTS: 1 DIF: L2 OBJ: 4.4 Acceleration
   STA: Ph.1.c KEY: acceleration BLM: application
10. ANS: C PTS: 1 DIF: L2 OBJ: 4.5 Free Fall: How Fast?
    STA: Ph.1.b | Ph.1.c | Ph.2.c KEY: air | resistance | acceleration
    BLM: comprehension
11. ANS: B PTS: 1 DIF: L2 OBJ: 7.3 Identifying Action and Reaction
    STA: Ph.1.d KEY: reaction | resistance BLM: comprehension
12. ANS: D PTS: 1 DIF: L2 OBJ: 4.2 Speed
    STA: Ph.1.a | Ph.1.b KEY: speed | average
    BLM: application
13. ANS: B PTS: 1 DIF: L2 OBJ: 4.6 Free Fall: How Far?
    STA: Ph.1.a | Ph.2.c KEY: free fall | speed
    BLM: application
14. ANS: C PTS: 1 DIF: L2 OBJ: 8.1 Momentum
    STA: Ph.2.d KEY: momentum BLM: application
15. ANS: B PTS: 1 DIF: L2 OBJ: 8.1 Momentum
    STA: Ph.2.d KEY: momentum | speed BLM: application
16. ANS: A PTS: 1 DIF: L2 OBJ: 21.1 Temperature
    KEY: temperature | kinetic BLM: comprehension
17. ANS: D PTS: 1 DIF: L1 OBJ: 21.5 Measurement of Heat
    STA: Ph.3.a | Ph.3.b KEY: heat | unit BLM: knowledge
18. ANS: A PTS: 1 DIF: L2 OBJ: 21.8 Thermal Expansion
    STA: Ph.3.c KEY: heat | expand BLM: comprehension

19. ANS: A PTS: 1 DIF: L2 OBJ: 21.8 Thermal Expansion
STA: Ph.3.c KEY: expand | freeze BLM: analysis
20. ANS: A PTS: 1 DIF: L1 OBJ: 24.1 Absolute Zero
STA: Ph.3.c | CA.IE.1i KEY: temperature | Kelvin
BLM: knowledge

PROBLEM

21. ANS:
250 kg·m/s

PTS: 1 DIF: L2 OBJ: 8.1 Momentum
STA: Ph.2.d KEY: momentum BLM: application
22. ANS:
20 N

PTS: 1 DIF: L2 OBJ: 8.2 Impulse Changes Momentum
STA: Ph.2.d | Ph.2.e KEY: force BLM: application
23. ANS:
3.5 m/s toward the right

PTS: 1 DIF: L2 OBJ: 8.5 Collisions
STA: Ph.2.g KEY: speed | direction BLM: application
24. ANS:
72 kg·m/s

PTS: 1 DIF: L2 OBJ: 8.2 Impulse Changes Momentum
STA: Ph.2.d | Ph.2.e KEY: speed | momentum
BLM: application
25. ANS:
2.0 m/s

PTS: 1 DIF: L2 OBJ: 8.4 Conservation of Momentum
STA: Ph.2.e KEY: speed BLM: application
26. ANS:
70 N·s

PTS: 1 DIF: L2 OBJ: 8.2 Impulse Changes Momentum
STA: Ph.2.d | Ph.2.e KEY: elastic | speed
BLM: application
27. ANS:
9 RPM

PTS: 1 DIF: L2 OBJ: 10.2 Rotational Speed
STA: Ph.1.l KEY: rotate | speed BLM: application

28. ANS:
14 m/s

PTS: 1 DIF: L2 OBJ: 10.2 Rotational Speed
STA: Ph.1.l KEY: speed BLM: application

29. ANS:
$\frac{1}{2}\,g$

PTS: 1 DIF: L2 OBJ: 10.4 Centripetal and Centrifugal Forces
STA: Ph.1.l KEY: rotate | acceleration BLM: application

30. ANS:
1,000 cal

PTS: 1 DIF: L2 OBJ: 21.6 Specific Heat Capacity
KEY: heat | temperature BLM: application

31. ANS:
3°C

PTS: 1 DIF: L2 OBJ: 21.6 Specific Heat Capacity
KEY: heat | water | volume BLM: application

32. ANS:
28°C

PTS: 1 DIF: L2 OBJ: 21.6 Specific Heat Capacity
KEY: specific heat | temperature BLM: application

33. ANS:
349°C

PTS: 1 DIF: L2 OBJ: 24.1 Absolute Zero
STA: Ph.3.c | CA.IE.1i KEY: kinetic | gas BLM: application

34. ANS:
0.06

PTS: 1 DIF: L2 OBJ: 24.5 Heat Engines and the Second Law
STA: Ph.3.b | Ph.3.g KEY: Carnot | efficiency
BLM: application

35. ANS:
$\frac{1}{4}$

PTS: 1 DIF: L2 OBJ: 13.4 Newton's Law of Universal Gravitation
STA: Ph.1.e | Ph.1.m KEY: Earth | mass | weight
BLM: application

36. ANS:
60 kg

PTS: 1 DIF: L2 OBJ: 13.5 Gravity and Distance:The Inverse-Square Law
STA: Ph.1.e | Ph.1.m KEY: mass | Earth | height
BLM: application

37. ANS:
67 N

PTS: 1 DIF: L2 OBJ: 13.5 Gravity and Distance:The Inverse-Square Law
STA: Ph.1.e | Ph.1.m KEY: mass | gravity | Earth
BLM: application