**Dynamics Unit Final Version Delta Bravo**

**Multiple Choice**

*Identify the choice that best completes the statement or answers the question.*

\_\_\_\_ 1. The specific heat of copper is 385 J/kg·K. If a 3.6 kg block of copper is heated from 300 K to 450 K, how much thermal energy is absorbed?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 22,000 J | c. | 158,000 J |
| b. | 270,900 J | d. | 150,000 J |

\_\_\_\_ 2. A spring (k = 880 N/m) has a length of 46 cm when zero net force is applied to it. What will its length be when 440 N of force is applied to stretch it?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 3.4 m | c. | 3.9 m |
| b. | 0.77 m | d. | 0.96 m |

\_\_\_\_ 3. Yohance uses a wheelbarrow to move soil from his garden to a new flowerbed. He exerts an average force of 265 N while pushing the wheelbarrow, and he does 7.4 kJ of work while moving each load of soil. How far is he moving the soil?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 0.026 m | c. | 27.9 m |
| b. | 0.039 m | d. | 39 m |

4. Tom and Kyle drag a box of mass 40.0 kg along a frictionless floor. Tom pushes the box with a force of 12.7 N at an angle of 40.0 downward from the horizontal. Kyle pulls the box from the other side with a force of 12.6 N at an angle of 32.0 above the horizontal. What is the net work done on the box if the displacement of the box is 15.0 m?(4)

5. Raul pushes a stalled car with a force of 218 N. If the required force decreases at a constant rate from 218 N to 32.0 N for a distance of 12.7 m in 13.0 s, calculate the average power required to move the car. Hummm seems kind of familiar doesn’t it.....(4)

6. A 1300-kg vehicle moves with a velocity of 18.0 m/s. Calculate the power required to reduce the velocity to 4.10 m/s in 15.0 s. (3)

1. A force of 200 N acts on a 7.20-kg bowling ball for 0.350 s. Calculate its change in velocity.(3)

2. A 1.5  10-2 kilogram bullet traveling at 850 m/s hits a block of wood. The bullet and wood together fly off in the same direction at 25 m/s. What is the impulse on the bullet?(3)

3. A 91 kg wide receiver with no horizontal speed leaps into the air to catch a 0.45 kg football moving at 27 m/s. What horizontal speed does the wide receiver obtain if he catches the football?(3)

5. Raul pushes a stalled car with a force of 207 N. If the required force decreases at a constant rate from 207 N to 54.0 N for a distance of 14.3 m in 17.0 s, calculate the average power required to move the car.(3)

7. You lift 440 N of water 3.0 m over a table in 1.45 seconds. What power have you generated?(2)

8. A student lifts a 1.9-kg bag from her desk, which is 0.69-m high, to a locker that is 2.5-m high. What is the gravitational potential energy of the bag relative to the desk?(3)

9. A 0.390-kg piece of wood is at rest on a frictionless table. A 8.30-g bullet, moving with a speed of 495 m/s, strikes the piece of wood, and is embedded in it. After the collision, the piece of wood and the bullet move slowly down the table. What percentage of the system’s original kinetic energy was lost?(4)

10. A dart with a mass of 0.025 kg traveling with a speed of 13 m/s impacts a dart board and stops. What work was done by the dart board in stopping the dart? Into what form did the dart’s kinetic energy change?(3)

11. A 1125 g piece of aluminum (specific heat = 897 J/kg·K) is heated to 325⁰C. If it is placed into 5.10 kg water (specific heat = 4180 J/kg·K) at 10⁰C, what will be the final temperature at equilibrium?(3)

12. Assess the following physics problem.

Two astronauts push off the space station and into deep space. The first pushes with an impulse of 5.0 N s in the positive direction. The second pushes with an impulse of 5.0 N s in the negative direction. Does the space station change its relative position?

What, if any, required information is missing to find the answer?(2)

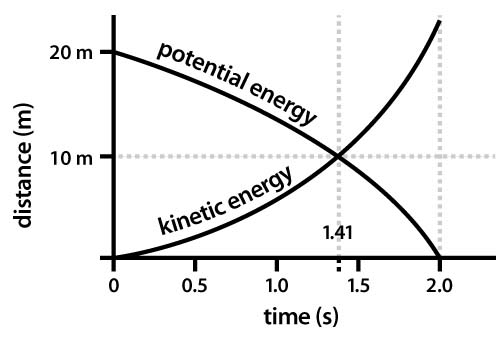
13. Critique the following statement: (2)

“Since work and energy have the same units, they measure the same thing.”

14. Why does work, even work that does not meet the physics definition of work, make us tired?(2)

15. Why is the first hill of a roller coaster generally the highest?(2)

16. Consider the graph showing the kinetic and potential energy for a falling body.



a) At what height and time are kinetic energy and potential energy equal?(1)

b) Why is the time not equal to 1/2 the total time of fall?(2)

**Dynamics Unit Final Version Alpha Tango**

**Answer Section**

**MULTIPLE CHOICE**

1. ANS: B PTS: 1 DIF: Bloom's Level 3

REF: p. 318 NAT: B.6

2. ANS: D PTS: 1 DIF: Bloom's Level 3

REF: p. 376 NAT: UCP.3

3. ANS: C PTS: 1 DIF: average OBJ: work

STA: 2.K.2.m

**PROBLEM**

1. ANS:

 J

PTS: 1 DIF: Bloom's Level 3 REF: Page 260

OBJ: 10.1.2 Calculate work. TOP: Calculate work.

KEY: Work MSC: 3

NOT: Work is equal to the product of force and displacement times the cosine of the angle between the force and the direction of the displacement.

2. ANS:

122 W

PTS: 1 DIF: Bloom's Level 3 REF: Page 263

OBJ: 10.1.3 Calculate the power used. TOP: Calculate the power used.

KEY: Power MSC: 3

NOT: Power is equal to the work done divided by the time taken to do the work.

3. ANS:

 W

PTS: 1 DIF: Bloom's Level 3 REF: Page 263

OBJ: 10.1.3 Calculate the power used. TOP: Calculate the power used.

KEY: Power MSC: 3

NOT: Work is equal to the change in kinetic energy. Power is equal to the work done divided by the time taken to do the work.

**new questions**

**Answer Section**

**PROBLEM**

1. ANS:

9.72 m/s

PTS: 1 DIF: Bloom's Level 3 REF: Page 230

OBJ: 9.1.2 Determine the impulse given to an object. NAT: B.4

TOP: Determine the impulse given to an object. KEY: Impulse

MSC: 3 NOT: Apply the impulse-momentum theorem to obtain the change in velocity.

2. ANS:

12 kg m/s

PTS: 1 DIF: Bloom's Level 3 REF: p. 230

NAT: B.4

3. ANS:

0.13 m/s

PTS: 1 DIF: Bloom's Level 3 REF: pp. 236-237

NAT: B.4

4. ANS:

 J

PTS: 1 DIF: Bloom's Level 3 REF: Page 260

OBJ: 10.1.2 Calculate work. TOP: Calculate work.

KEY: Work MSC: 3

NOT: Work is equal to the product of force and displacement times the cosine of the angle between the force and the direction of the displacement.

5. ANS:

115 W

PTS: 1 DIF: Bloom's Level 3 REF: Page 263

OBJ: 10.1.3 Calculate the power used. TOP: Calculate the power used.

KEY: Power MSC: 3

NOT: Power is equal to the work done divided by the time taken to do the work.

6. ANS:

6.3  104 J

PTS: 1 DIF: Bloom's Level 3 REF: pp. 259-260

NAT: B.5 | B.6

7. ANS:

910.34W

PTS: 1 DIF: Bloom's Level 3 REF: pp. 263, 265

NAT: B.5 | B.6

8. ANS:

34 J

PTS: 1 DIF: Bloom's Level 2 REF: Page 285

OBJ: 11.1.3 Determine the gravitational potential energy of a system.

TOP: Determine the gravitational potential energy of a system. KEY: Gravitational potential energy

MSC: 3

NOT: The gravitational potential energy of an object is equal to the product of its mass, the acceleration due to gravity, and its height from the reference level.

9. ANS:

97.9 %

PTS: 1 DIF: Bloom's Level 3 REF: Page 293

OBJ: 11.2.2 Analyze collisions to find the change in kinetic energy.

TOP: Analyze collisions to find the change in kinetic energy. KEY: Collisions

MSC: 3

NOT: Use the conservation of momentum equation to find the final velocity. Determine the change in kinetic energy of the system. Use the change in the kinetic energy to find the fraction of the original kinetic energy lost.

10. ANS:

2.1 J. The energy of the dart was changed into heat energy via friction between the dart’s tip and the dart board.

PTS: 1 DIF: Bloom's Level 3 REF: pp. 294-295

NAT: B.5 | B.6

11. ANS:

Qa + Qb = 0

(1.125 kg)(897 J/kg·K)( 325C) + (5.10kg)(4180J/kg·K)( 10C) = 0

 = 24.2C

PTS: 1 DIF: Bloom's Level 4 REF: pp.318-319

NAT: B.6

**ESSAY**

12. ANS:

No information is missing. The space station does not change its relative position because the impulses are equal and opposite.

PTS: 1 DIF: Bloom's Level 6 REF: p. 238

NAT: B.4

13. ANS:

While work and energy are closely related, they are distinct concepts. Work is strictly defined as force applied in the direction of a displacement multiplied by that displacement. Energy is a property that a body can possess. Earth possesses kinetic energy as it orbits Sun but (unless it collides with another body) that kinetic energy does not result in any work done.

PTS: 1 DIF: Bloom's Level 6 REF: p. 259

NAT: B.5 | B.6

14. ANS:

Answers will vary. Any muscle exertion requires the burning of the body’s fuel, resulting in the release of waste products, the loss of body energy reserves, and a feeling of being tired. Consider an analogy with a gasoline engine. An engine burns fuel to move over a distance, overcoming forces such as friction, air resistance, and the car’s brakes if they are applied. But that same car will still burn fuel in a tug-of-war with another car, even though no work is done.

PTS: 1 DIF: Bloom's Level 5 REF: pp. 257-258

NAT: B.5 | B.6

15. ANS:

The roller coaster gains gravitational potential energy by climbing the hill (usually with the help of a chain or some other lifting device). It has essentially no kinetic energy at the top of this hill, so all its mechanical energy is stored as gravitational potential energy. If another hill were higher, the roller coaster would not be able to reach this higher hill, even if no energy was lost during the ride.

PTS: 1 DIF: Bloom's Level 2 REF: p. 294

NAT: B.5 | B.6

16. ANS:

a) The kinetic and potential energy are equal at 10 meters, half the distance of the fall, and at 1.4 seconds, almost 3/4 the time of the fall.

b) The body speeds up as it falls, so the majority of the time of the fall is spent falling the first half of the distance. It is in this first half of the fall that the body is moving slowest.

PTS: 1 DIF: Bloom's Level 4 REF: pp. 287-289, 293-294

NAT: B.5 | B.6

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REF: p. 376 NAT: UCP.3

3. ANS: C PTS: 1 DIF: average OBJ: work

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