**Core Science 221, Section 1** **NAME:**

**Homework 2: Force, Work, Kinetic Energy, Potential Energy:** Homeworks are due as posted on the course web site. Enter the answer to the multiple-choice questions on the answer table beside the number corresponding to the question. There may be gaps in the table when full-answer questions appear in the homework. You only need to hand in the table for the multiple-choice questions. Solutions will be posted eventually after the due date.

## Answer Table

## Name:

| | a | b | c | d | e | | a | b | c | d | e |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | O | O | O | O | O | 31. | O | O | O | O | O |
| 2. | O | O | O | O | O | 32. | O | O | O | O | O |
| 3. | O | O | O | O | O | 33. | O | O | O | O | O |
| 4. | O | O | O | O | O | 34. | O | O | O | O | O |
| 5. | O | O | O | O | O | 35. | O | O | O | O | O |
| 6. | O | O | O | O | O | 36. | O | O | O | O | O |
| 7. | O | O | O | O | O | 37. | O | O | O | O | O |
| 8. | O | O | O | O | O | 38. | O | O | O | O | O |
| 9. | O | O | O | O | O | 39. | O | O | O | O | O |
| 10. | O | O | O | O | O | 40. | O | O | O | O | O |
| 11. | O | O | O | O | O | 41. | O | O | O | O | O |
| 12. | O | O | O | O | O | 42. | O | O | O | O | O |
| 13. | O | O | O | O | O | 43. | O | O | O | O | O |
| 14. | O | O | O | O | O | 44. | O | O | O | O | O |
| 15. | O | O | O | O | O | 45. | O | O | O | O | O |
| 16. | O | O | O | O | O | 46. | O | O | O | O | O |
| 17. | O | O | O | O | O | 47. | O | O | O | O | O |
| 18. | O | O | O | O | O | 48. | O | O | O | O | O |
| 19. | O | O | O | O | O | 49. | O | O | O | O | O |
| 20. | O | O | O | O | O | 50. | O | O | O | O | O |
| 21. | O | O | O | O | O | 51. | O | O | O | O | O |
| 22. | O | O | O | O | O | 52. | O | O | O | O | O |
| 23. | O | O | O | O | O | 53. | O | O | O | O | O |
| 24. | O | O | O | O | O | 54. | O | O | O | O | O |
| 25. | O | O | O | O | O | 55. | O | O | O | O | O |
| 26. | O | O | O | O | O | 56. | O | O | O | O | O |
| 27. | O | O | O | O | O | 57. | O | O | O | O | O |
| 28. | O | O | O | O | O | 58. | O | O | O | O | O |
| 29. | O | O | O | O | O | 59. | O | O | O | O | O |
| 30. | O | O | O | O | O | 60. | O | O | O | O | O |

1. "Let's play *Jeopardy*! For \$100, the answer is: A push or a pull in everyday speech."

   What is a/an ____________, Alex?

   a) acceleration  b) velocity  c) momentum  d) force  e) angular momentum

2. This thing can be defined (but only incompletely) as a physical relationship between bodies that can cause an acceleration and/or cancel other things of the same kind and/or cause a deformation of the bodies. The thing is:

   a) acceleration.  b) velocity.  c) force.  d) momentum.  e) maneuver.

3. Forces in physics can be categorized in various ways. One way is as:

   a) short- and long-range forces.  b) right and wrong forces.  c) good and evil forces.
   d) short and tall forces.  e) avant-garde and reactionary forces.

4. "Let's play *Jeopardy*! For \$100, the answer is: It is a force caused by a field: it can also be called a body force, but that expression seems to be somewhat pass/'e nowadays. A field is a thing that permeates all space at least within some region and has a well defined value at each point. To cause a force, a field must be a vector field. This means at each point in space it has magnitude and direction. If a force is caused by a field it is usually considered a long-range force since such forces between bodies don't require the bodies to be touching in a macroscopic sense. Actually at the microscopic level all forces are caused by fields."

   What is a ____________, Alex?

   a) contact force  b) field force  c) branching force  d) truth force  e) back force

5. A short-range force is usually one that requires the interacting bodies to be touching in a macroscopic sense. Such forces nowadays are usually called:

   a) truth forces.  b) branching forces.  c) contact forces.  d) back forces.
   e) forth forces.

6. "Let's play *Jeopardy*! For \$100, the answer is: It is the standard SI unit of force."

   What is the ____________, Alex?

   a) pound lb  b) newton (N)  c) joule (J)  d) watt (W)  e) kilowatt-hour (kWh)

7. "Let's play *Jeopardy*! For \$100, the answer is: Expending energy and moving things around and getting things done."

   What is ____________, Alex?

   a) resting  b) force  c) common sense  d) staring out the window  e) work

8. "Let's play *Jeopardy*! For \$100, the answer is: The formula

   $$W = Fd ,$$

   where $d$ is displacement moved for a body and $F$ is the component along the direction of motion of a constant force acting on the body.

   What is the ____________, Alex?

   a) work formula  b) kinetic energy formula  c) potential energy formula
   d) energy formula  e) rest formula

9. The derived standard SI unit of work is the:

   a) pound (lb).  b) newton (N).  c) joule (J).  d) watt (W).  e) kilowatt-hour (kWh).

10. You have pushed an object of in straight line for 10 m with 10 N of force aligned with the direction of motion. The work you have done on the object is:

    a) 10 J.  b) 100 J.  c) 20 J.  d) 13 J.  e) none of the above.

11. The work-kinetic-energy theorem is:

a) $\Delta KE = W$ . b) $\Delta KE = \frac{1}{2}W$ . c) $\Delta KE = \frac{1}{3}W$ . d) $\Delta KE = \frac{1}{W}$ .
e) $\Delta KE = \frac{1}{2W}$ .

12. The work done ($W$) by a net force on an object equals:

    a) the object's total kinetic energy of the body ($KE$). b) the object's change in kinetic energy of the body ($\Delta KE$). c) 1 joule. d) joules. e) the heat absorbed by the body ($\Delta Q$).

13. A body starts from **REST** and is acted on by a single force. The total work done on the body is 100 J. The body's mass is 1 kg. Approximately what is the body's final speed?

    a) 100 m/s. b) 200 m/s. c) 1 m/s. d) 14 m/s. e) 4000 m/s.

14. You pushed a piano along its path of motion on a level surface with 500 N (i.e., about 112 lb) of force for 100 m. At the end of that haul, the piano is at **REST**. How much work did you do on the piano and where did the energy go that you expended?

    a) $5 \times 10^4$ J. It went into waste heat.
    b) $1.12 \times 10^4$ J. It went into the gravitational potential energy of the piano.
    c) 500 J. It went into waste heat.
    d) 100 J. It went into the gravitational potential energy of the piano.
    e) $5 \times 10^4$ J. It went into the kinetic energy of the piano.

15. "Let's play *Jeopardy*! For \$100, the answer is: The force of gravity near the Earth's surface."

    What is ____________, Alex?

    a) $F = mgy$ b) $KE = \frac{1}{2}mv^2$ c) $W = Fd$ d) $F = \frac{m}{g}$ e) $F = mg$

16. The constant $g$ in the gravity force law for near the Earth's surface is

    a) exactly $9.8\,\mathrm{m/s^2}$.
    b) defined to be exactly $9.8\,\mathrm{m/s^2}$.
    c) $9.8\,\mathrm{m/s^2}$, but this is only a standard reference (or fiducial) value since $g$ varies by a small amount with location.
    d) $9.8\,\mathrm{m/s^2}$, but this is only a standard reference (or fiducial) value since $g$ varies by more 30 % from this value depending on location on Earth.
    e) $9.8\,\mathrm{m/s^2}$, but this is only a standard reference (or fiducial) value since $g = 9.1\,\mathrm{m/s^2}$ actually.

17. "Let's play *Jeopardy*! For \$100, the answer is: It is the formula for the change in gravitational potential energy near the Earth's surface."

    What is ____________, Alex?

    a) $KE = \frac{1}{2}mv^2$ b) $\Delta PE = mg\Delta y$ c) $F = mg$ d) $F = mgy$ e) $W = Fd$

18. "Let's play *Jeopardy*! For \$100, the answer is: This form of energy has no physically determined zero-level or zero-point. The zero-level is chosen for mental or calculational convenience in any particular physical system."

    What is ____________, Alex?

    a) kinetic energy b) thermal energy c) potential energy d) red-hot energy
    e) cinematic energy

19. In a moment of euphoria, you toss your cell phone straight up in the air—sort of like Mary Richards in the *Mary Tyler Moore Show* (1970–1977)—except, not having a cell phone, it was her hat. Take the starting point where it leaves your hand as the zero level for gravitational potential energy ($PE$). For the cell phone, the initial energy just after release was all ____________; the top-of-the-trajectory energy was all ____________; the final energy just before you catch it at the same height you released it was all ____________.

    a) $KE$; $KE$; $PE$ b) $KE$; $KE$; $KE$ c) $PE$; $KE$; $PE$ d) $KE$; $PE$; $KE$
    e) $PE$; $KE$; $KE$

20. You have a mass of 70 kg and have just hiked up 400 m in elevation in 30 minutes. Approximately what is the total energy you have put into your gravitational potential energy in your climb. Approximately what was your average power output to gravitational potential energy? Your total power output was more because some energy went into keeping your body going and some ultimately into ____________. Recall $g = 9.8\,\mathrm{m/s^2}$.

    a) $2.8 \times 10^5$ J; $2.8 \times 10^5$ W; waste heat b) $2.8 \times 10^5$ J; 150 W; waste heat c) $2.8 \times 10^4$ J; 150 W; waste heat d) $2.8 \times 10^5$ J; $10^4$ W; electrical potential energy e) $2.8 \times 10^4$ J; $10^4$ W; chemical energy