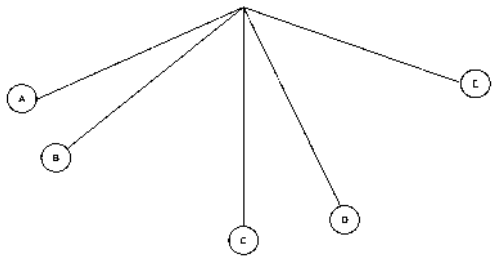
Name: _____ **Date:** _____ **Period:** ____

P. Sci. Unit 4 (Ch. 16 & 16): Energy Review --- Answer Key

Show ALL calculations on a separate piece of paper.

Chapter 15

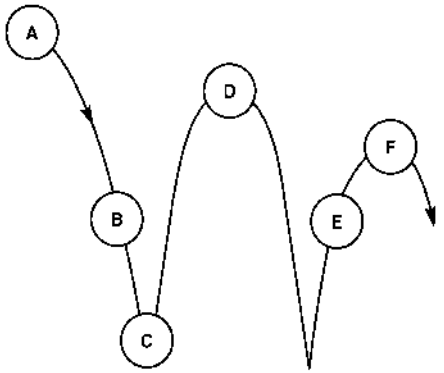
1. Define work: Work is the product of force and distance.
2. Define energy: Energy is the ability to do work.
3. Energy is measured in Joules (J).
4. Give an example for each of the following types of energy
   a. Kinetic a pendulum swinging back and forth
   b. Gravitational Potential a book on a shelf
   c. Elastic Potential a stretched rubber band
   d. Chemical Potential food, gasoline
   e. Mechanical running a lawnmower
   f. Thermal a bonfire
   g. Nuclear the sun
   h. Electromagnetic heat waves from the sun
   i. Electrical an iPad charging in the wall
5. Energy in the form of motion is kinetic energy.
6. A rock at the edge of a cliff has gravitational potential energy because of its position.
7. Energy that is stored is potential energy.
8. Energy stored in food you eat is chemical energy
9. Total mechanical energy is the total potential and kinetic energy in a system.
10. Elastic energy is stored in a stretched rubber band.
11. A book sitting on a shelf has gravitational potential energy.
12. Gravitational potential energy depends on mass, gravity, and height.
13. The primary source of the sun's energy is nuclear.
14. A pendulum is swinging back and forth, starting at point A and ending at point E as shown in the image below. At what point(s) is the pendulum's:
    a. Kinetic energy decreasing D
    b. Kinetic energy increasing B
    c. Kinetic energy the HIGHEST C
    d. Kinetic energy the LOWEST A
    e. Potential energy decreasing B
    f. Potential energy increasing D
    g. Potential energy the HIGHEST A
    h. Potential energy the LOWEST C



15. The law of conservation of energy states that: Energy cannot be created or destroyed.
16. Increasing the speed of an object (increases / decreases / does not affect) its potential energy.
17. The SI unit for energy is the Joule (J).
18. A bus engine transfers chemical potential energy into mechanical energy so that the bus moves.
19. According to the Law of Conservation of Energy, the total amount of energy in the universe stays the same; does not change.
20. On a swing your potential and kinetic energies change, but your total mechanical energy does not.
21. When you move your hand or foot, your body has converted potential energy into kinetic energy.

Problems

22. What is the gravitational potential energy of a 55 kg box that is 8.0 m above the ground? GPE = mgh so 55 kg • 9.8 m/s^2 • 8.0 m = **4312 J**
23. A medicine ball has a mass of 5 kg and is thrown with a speed of 2 m/s. What is its kinetic energy? KE =½mv^2 so ½ • 5 kg • (2 m/s)^2 = **10 J**
24. An object has a kinetic energy of 810 J after falling a certain distance. If the mass of the object is 20 kg, what is the speed of the object at this time? KE =½mv^2 so 810 ÷ (½ • 20 kg) = 810 ÷ 10=$\sqrt{81}$ = 9 m/s
25. A ball has 100 J of potential energy when it is on a shelf.
    a. Explain what happens to the potential energy and the kinetic energy as the ball falls. PE decreases while KE increases (PE↓, KE↑)
    b. Find the amount of kinetic energy the ball has at the instant it hits the floor. 0 J because it is not moving the instant it hits the ground
26. An 18-kg bicycle carrying a 62-kg girl is traveling at a speed of 7 m/s. What is the kinetic energy of the girl and bicycle? KE =½mv^2
    KE = ½ • 80 kg • (7 m/s)^2 = 40 • 49 = 1960 J
27. A 90-kg ceiling light is suspended 4 m above the floor. What is its gravitational potential energy? GP =mgh so 90 kg • 9.8 m/s^2 • 4 m= 3528 J
28. Using the image to the right label the points where :



    a. A Potential energy is the greatest.
    b. C Kinetic energy is the greatest.
    c. B & E Where BOTH are present.

Chapter 16

29. What is related to the average kinetic energy of the particles in that object? Temperature
30. As the temperature of mercury inside the thermometer increases, its volume increases.
31. Energy is transferred as heat from a substance at (low / high) temperature to a substance at (low / high) temperature.
32. Heating by convection can occur through (solids / liquids / gases).
33. Radiation is the only method of energy **transfer** that can take place in a vacuum.
34. Convection is the only method of energy **transfer** that takes place in a fluid.
35. Conduction is the only method of energy **transfer** that requires contact of the objects.
36. Heat is the transfer of thermal energy because of a temperature difference.
37. A good insulator is a poor conductor.

Specific Heats at 25K

Substance	c (j/kg•K)	Substance	c (j/kg•K)
Water (liquid)	4186	Copper	385
Steam	1870	Gold	129
Ammonia (gas)	2060	Iron	449
Ethanol (liquid)	2440	Mercury	140
Aluminum	897	Lead	129
Carbon (graphite)	709	Silver	234

38. Does it take more energy as heat to raise the temperature of water by one degree than to raise the temperature of steam by the same amount? Explain. It takes more energy as heat to raise the temperature of water than it does for steam because water has a higher specific heat (4186 J/kg•K).
39. Using the table, determine which substance can absorb the most energy in a temperature increase of 1K. Water (liquid); b/c it has highest spec. heat
40. Which substance has a specific heat approximately 10 times greater than the specific heat of silver? Ethanol (liquid); its specific heat is approx.. 10 times greater than that of silver.
41. The temperature of 1.5 kg of ethanol is 37 K. What will the final temperature be if 80,000 J of energy as heat is added to the ethanol? $Q = mc\Delta T$; Q = 80,000J, m = 1.5kg, c = 2440 j/kg•K, ΔT = ? =80,000 J÷(1.5kg•2440 J/kg•K)=80,000 ÷3660 J/K=2.18K + 37K=39.18 K
42. 10 kg of a substance underwent a 3 K change in temperature when 11,500 J of energy as heat was added to the substance. What is the substance? Copper
43. What is –175ºC on the Kelvin scale? -175 ºC + 273 = 98 K
44. As the kinetic energy of the molecules in a substance increases, the temperature increases.
45. The transfer of energy by the movement of fluids or gases with different temperatures is called convection.
46. Energy from the sun reaches Earth by radiation.
47. Convection currents rise in air because hot air rises and cool air falls.
48. Which method of energy transfer does not involve movement of matter? radiation
49. How much heat energy will cause the temperature of 7 kg of iron to increase its temperature by 15 K? The specific heat of iron is 449 J/kg·K. m = 7kg, c = 449 J/kg·K, ΔT = 15K so Q = 7kg·449 J/kg·K·15K = 47145 J
50. A cold-blooded reptile basks on a warm rock in the sun. Its body is warmed by radiation (heat waves) and conduction (sitting on a warm rock).
51. The temperature of a substance increases by 3 K when 1635 J is added to a 2 kg quantity of the substance. What is the specific heat of the substance? $Q = mc\Delta T$; Q=1635J, m=2kg, ΔT=3K so c=1635J÷(2kg·3K)=272.5 J/kg·K
52. How many **kilojoules** of heat must be transferred to a 670-g aluminum pan to raise its temperature from 32°C to 250°C? The specific heat of aluminum is 0.96 J/g·°C. $Q = mc\Delta T$; m=670g, c=0.96J/g·°C, ΔT=(250°C-32°C)=218°C Q = 670g · 0.96J/g·°C · 218°C = 140217.6J which is 140.22kJ
53. Temperature is a measure of the average kinetic energy of all the particles within an object.
54. The energy transferred between the particles of two objects because of the temperature difference between the two objects is called heat/thermal energy.
55. Conduction is the energy transfer as heat between particles as they collide within a substance or between two objects in contact.
56. Convection is the transfer of energy by the movement of fluids with different temperatures.
57. The movement of a gas or liquid due to expansion and contraction caused by temperature differences within the fluid is called convection.
58. The transfer of energy as waves moving through space is called radiation.
59. A(n) conductor is a material through which energy can be easily transferred as heat.
60. A(n) insulator is a material that is a poor energy conductor.
61. Define specific heat: amount of energy required to raise the temp. of 1 kg of material by 1 degree Kelvin (J/(kg·K) or J/(kg·°C).