**P. Sci. Unit 4 Worksheet** Put all your answers on a separate sheet of notebook paper.

## Chapter 15

1. Energy (does / doesn't) have to involve motion.
2. Energy is measured in __joules__.
3. Energy in the form of motion is _kinetic_ energy.
4. A rock at the edge of a cliff has _potential_ energy because of its position.
5. Energy that is stored is _potential_ energy.
6. Energy stored in food you eat is _chemical potential_energy
7. _Mechanical_ energy is the total potential and kinetic energy in a system.
8. _Elastic_ energy is stored in a stretched rubber band.
9. A book sitting on a shelf has _gravitaional potential_energy.
10. Gravitational potential energy depends on the _mass of the object, the acceleration due to gravity and the height of the object_
11. The primary source of the sun's energy is _nuclear fusion_
12. A pendulum is swinging back and forth and has a kinetic energy of 400 J at a particular point in its path. Which of the following statements is **not** true?
    a) Both the kinetic and potential energy are decreasing
    b) When the kinetic energy is zero, the potential energy will be 400 J greater
    c) The minimum kinetic energy is zero
    d) The potential energy increases when the kinetic energy decreases
13. The law of conservation of energy states that energy can neither be created nor destroyed – only changed_
14. Increasing the speed of an object does not affect_ its potential energy
15. The SI unit for energy is the _joule_.
16. You can calculate kinetic energy by using the equation _KE = 1.2 m x $v^2$_.
17. You can calculate gravitational potential energy by using the equation _GPE = m x g (9.8 m/$s^2$) x h_.
18. A bus engine transfers chemical potential energy into _Kinetic energy_ so that the bus moves.
19. According to the law of conservation of energy, the total amount of energy in the universe _remains constant_.
20. On a swing your potential and kinetic energies change, but your _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? 4300 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? 10 J
24. An object weighing 75 N is dropped from the top of a building and falls a distance of 28 m to the ground. How much work does gravity do on the object from the time it is dropped to the time it hits the ground? 2100 J
25. 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? 9 m/s
26. A ball has 100 J of potential energy when it is on a shelf. Explain what happens to the potential energy and the kinetic energy as the ball falls, and find the amount of kinetic energy the ball has at the instant it hits the floor. A ball on a shelf has potential energy. As it falls, the potential energy is converted into kinetic energy according to the conservation of energy. When it hits the floor, it has 100 J of kinitic energy
27. 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? \
    $1/2\ mv^2 = 1/2\ (18 + 62)(7)^2 = 1{,}960$ J
28. A 20-kg bicycle carrying a 50-kg girl is traveling at a speed of 8 m/s. What is the kinetic energy of the girl and bicycle?
    $1/2\ mv^2 = 1/2\ (20 + 50)(8)^2 = 2{,}290$ J
29. A 70-kg boy is sitting 3 m from the ground in a tree. What is his gravitational potential energy?
    $(m)(9.8)(h) = (70)(9.8)(3) = 2{,}058$ J
30. A 90-kg ceiling light is suspended 4 m above the floor. What is its gravitational potential energy?
    $(m)(9.8)(h) = (90)(9.8)(4) = 3{,}528$ J

## Chapter 16

31. As the temperature of mercury inside the thermometer increases, its volume _increases_.

32. Energy is transferred as heat from a substance at _High_ temperature to a substance at __low_ temperature.
33. Heating by convection can occur through _liquids__, or _gasses_.
34. _Radiation_ is the only method of energy transfer that can take place in a vacuum.
35. A good insulator is a _poor_ conductor.

Specific Heats at 25°C

| 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 |

36. 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. Yes, The specific heat of water is 4186 which is much higher than 1879 for steam – that means that more energy is needed to raise the temperature of water.
37. Using the table, determine which substance can absorb the most energy in a temperature increase of 1K Liquid water
38. Which substance has a specific heat approximately 10 times greater than the specific heat of silver? ethanol
39. The temperature of 1.5 kg of ethanol is 37ºC. What will the final temperature be if 80 000 J of energy as heat is added to the ethanol? 59 ◦C
40. 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
41. What is –175ºC on the Kelvin scale? 98 K
42. As the kinetic energy of the molecules in a substance increases, the _temperature of the substance increases._
43. The transfer of energy by the movement of fluids or gases with different temperatures is called _convection_
44. Energy from the sun reaches Earth by _radiation_
45. Convection currents rise in air because _cool air descends and hot air rises_
46. Which method of energy transfer does not involve movement of matter? Radiation
47. How much heat energy will cause the temperature of 7 kg of carbon to increase its temperature by 15 K? The specific heat of iron is 449 J/kg•K. $4.7 \times 10^4$ J
48. A cold-blooded reptile basks on a warm rock in the sun. Its body is warmed by _radiation and conduction_
49. 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? 272 J/kg•K
50. _Temperature_ is a measure of the average kinetic energy of all the particles within an object.
51. A(n) _thermometer_ is a device for measuring temperature
52. _Absolute zero_ is the temperature at which an object's energy is minimal.
53. The energy transferred between the particles of two objects because of the temperature difference between the two objects is called _heat_.
54. _Conduction_ is the energy transfer as heat between particles as they collide within a substance or between two objects in contact.
55. _Convection_ is the transfer of energy by the movement of fluids with different temperatures.
56. The movement of a gas or liquid due to expansion and contraction caused by temperature differences within the fluid is called a _convection current_.
57. __Radiation_ is the transfer of energy by electromagnetic waves.
58. A(n) __conductor_ is a material through which energy can be easily transferred as heat.
59. A(n) _insulator__ is a material that is a poor energy conductor.
60. __Specific heat_ is the amount of energy transferred as heat that will raise the temperature of 1 kg of a substance by 1 K.
61. A(n) _heating system_ is any device that transfers energy to a substance to raise the temperature of the substance.
62. A(n) __cooling system_ is a device that transfers energy out of an object to lower its temperature.