Shedding Light on Energy Episode 3: Energy Efficiency Name: _____

Part A

1. Only about _____ percent of the _____ energy that goes into an incandescent light globe is transformed into _____ energy. The rest (_____ percent) is transformed into _____ energy.
2. What is efficiency? _____
   _____
   _____

Part B

3. What is a Watt, W? _____
   _____
   _____
4. (a) 1 Watt = _____ Joule/second (b) 5 W = _____ J/s
5. A 10 W LED light globe uses _____ Joules of electrical energy per second.
   Therefore, in 1 second it will use _____ Joules of energy. In 2 seconds it will use _____ Joules of energy. In 3 seconds it will use _____ Joules of energy. In 20 seconds it will use _____ Joules of energy.
6. A 40 W incandescent light globe uses _____ Joules of electrical energy per second.
7. If it has an efficiency of 2%...
   (a) how much light energy is produced per second? _____
   (b) how much heat energy is produced per second? _____
8. If a 10 Watt LED globe is 20% efficient, what power (how many joules per second) of light will be produced, and what power of heat will be produced?
9. With respect to your answers in Qs 6 and 7 above, compare the performances of the incandescent and the LED globes. _____
   _____
   _____
10. Fats contain more energy than carbohydrates, but athletes usually fuel up on carbohydrate-rich foods before a big game? Why? _____
    _____
    _____

Part C

11. When (approximately) did the first incandescent light globes become commercially available? _____
12. Fill in the missing values.

Incandescent globes	Fluorescent globes	LED globes
electrical → light (_____%)	electrical → light (_____%)	electrical → light (_____%)
electrical → heat (_____%)	electrical → heat (_____%)	electrical → heat (_____%)

13. What is a lumen, lm? _____
    _____

14. The LED globe shown (here and in the video) produces _____ lumens of light and consumes _____ W of electrical power. The compact fluorescent globe shown (here and in the video) produces _____ lumens of light and consumes _____ W of electrical power.

15. How many lumens does each globe in Q14 produce <u>per watt</u>? (Calculate the no. of <u>lumens per watt</u>, lm/W.)
    LED Compact Fluorescent
16. Draw Sankey diagrams showing the energy input and energy output of an incandescent globe <u>and</u> an LED globe.
17. A certain electric motor has an efficiency of 90% (that is, 90% of the electrical energy it uses is converted into kinetic energy and rest is wasted as heat energy. Draw a Sankey diagram for this motor.

18. A fellow student tells you that he read that solar panels have an efficiency of 20%, but he doesn't fully understand what that means. Explain to him what it means. _____

_____

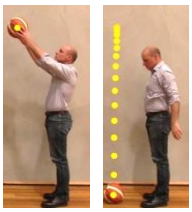
_____

Part D

19. What happens to the kinetic energy of a moving car when it comes to a stop? _____

_____

_____



20. A ball that has been lifted up has _____ _____ energy. When it is allowed to fall, this energy decreases and its _____ energy increases. When it hits the floor, it stops for a fraction of a second and deforms. The _____ energy that it had just before it hit is transformed into _____ _____ energy. This energy is then returned to the ball when it bounces back up again. However, some energy is "lost" in the form of _____ energy.

(b) How does the speed of a ball after it bounces off a surface compare to its speed just before it hits the surface? Why? _____

_____

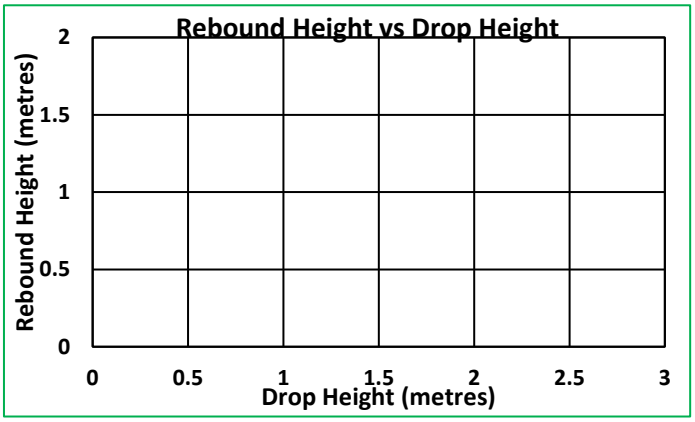
(c) How does the rebound height of a ball compare to the drop height? _____

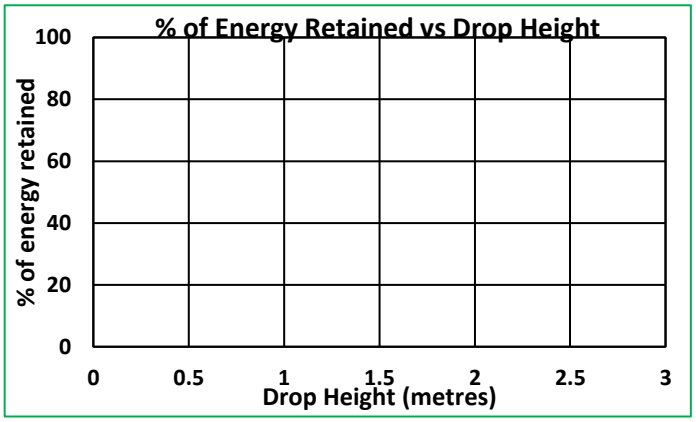
_____

_____

Drop Height (m)	Rebound Height (m)	% of energy retained	% of energy "lost" (as heat)
0.5	0.46		
1	0.78		
1.5	1.03		
2	1.27		
2.5	1.50		

21. A student drops a ball from various heights and records the rebound heights. (a) Fill in the rest of the table.
(b) Draw a line graph of "rebound height" vs "drop height".
(c) Draw a line graph of "% of energy retained" vs "drop height".





In Q22 below, you will use a scientific technique called "extrapolation" in which scientists estimate a value by first assuming that a trend in a set of results will continue.

22. You should be able to see a trend in the line graphs above. By extending the lines you have drawn…
    (a) estimate what the rebound height of the ball will be if it is dropped from **3 metres.** _____
    (b) estimate the % of the energy that will be retained if it is dropped from **3 metres.** _____
23. When you're jumping on a trampoline and you land on the fabric, you come to a complete stop for a fraction of a second before you jump back up again? What happened to the kinetic energy that you had immediately before you landed? _____

_____

Part E

24. What are tendons and what are ligaments? _____

_____

_____

25. Describe how the ligaments, tendons and muscles of our feet improve the efficiency of walking and running.

_____

_____

26. Why are small winglets placed at the end of aeroplane wings? _____

_____

_____