

**PART A. Steps involved in the Cartoon**

- Step -1 A person is shown throwing away 60 watts incandescent bulb and replacing it with energy efficient compact fluorescent lamp of 15 watts.
- Step-2 Bulb is deflects and falls on one end of balance pushing the other end up.
- Step-3. The action described in step 2 causes upward movement of the wedge, thus releasing the ball, which was held.
- Step-4. The ball moves and hits on one end of a lever. This end of the lever goes down and other end goes up.
- Step-5. The downward movement of the lever pushes the piston down causing compression of the fluid.
- Step-6. The fluid flows through the hose and sprayed against a cup end.
- Step-7. The scissors shaped links pulled up so that the pointed finger, which was held under groove, is released.
- Step -8. Due to the spring action the lever pulls the clasping mechanism, in turn releasing the ball.
- Step -9. The ball falls down on one end of the lever pressing the other end of the lever to go up.
- Step -10. The ball bounces and hits the other lever.
- Step -11. This end of the lever comes down and the other end goes up, which in turn is connected to a scissor.
- Step -12. The above action causes the scissor to cut the thread, which has weight at one end and gas filled balloon at the other end.
- Step -13. The cutting of the thread causes release of balloon
- Step -14. The gas filled balloon flies up hitting the lever.
- Step-15. This lever end comes up, so the other end goes down. The ball supported on other end falls down and moves on the path hitting a plate connected to the gear.
- Step -16. The gear moves back with rack pushing the lever, causing the container to tilt down and let the water fall down.
- Step-17 The liquid from the container falls in the glass. Because of the weight of the water, the hand which is holding the glass, lowers down causing movement of rack & pinion.
- Step -18 The hand connected to rack pushes down lever opening up the jaws at other end.
- Step -19. As the jaws open up the load falls down on a lever.
- Step -20. Other end of the lever comes up, the connected mechanism triggers the ball to start sliding down.
- Step-21 The ball falls into spiral shaped pipe and comes out from the other end and open up the box and rabbit inside the box jumps out on the tread mill. This movement causes lifting up of the shutter & release of spring loaded hand.
- Step-22. The forward moving hand out of the box activates the hammer.
- Step -23. The hammer breaks the ILB. (Giving the message that we should break all bulbs in our homes?).
- Step -24. The breaking of bulb starts falling down of weight which activates movement of rack and pinion pushing the rack.
- Step-25. The forwarding movement of the rack disengages the links.
- Step-26. As the lever disconnects, the spring retracts and other lever goes up and the hand pushes the channel up.
- Step-27. The ball falls on one of the lever. Then lever at the other end goes down hitting the candle.
- Step-28. The burning candle heats the metal, due to heat expansion of the metal takes place.
- Step-29. The expansion of metal pushes the spring causing the ball to fall down.
- Step 30. The falling ball hits a lever which is connected to gear.
- Step -31. Due to the movement of the pinion the bottle resting on a plate drops down. This causes the upward movement of thread thus opening up the display. The display shows the various developments about a lighting. Earlier, we were using candles, then Edison invented the

bulb, after that CFLs were developed. In near future we are having LED bulbs. However, if we do not use energy judiciously, we may have to again start using candles.

## **PART B. Useful Energy Output**

### **1. Estimate how large is “?” in percent.**

Incandescent Light Bulb converts only about 1.5 to 2% of the energy in coal provided to a power plant to generate a useful energy output. This assumes if there are no losses in transmission and distribution. However, considering the losses the figure might be about 1 to 1.5 % only

### **2. What is the “useful energy output” of a CFL.**

The useful Energy Out put of a CFL is about 3 –4 times more than that of Incandescent Light Bulb. Hence, the useful energy figure for CFL would be about 5 -6%

### **3. Where is the energy lost its way from coal to electricity consumed by CFL.**

- i) 60-65% energy is lost in conversion i.e. in boiler, turbine, generator
- ii) 10-15% is lost in Transmission & Distribution ( If only technical losses are taken into account and not theft as is prevalent in India.
- iii) 20-25% is lost in Ballast and heat

If we consider the energy consumed in transportation of coal also then the usefull energy output will be still less.

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