**Q1.**The table gives data about two types of low energy bulb.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Type of bulb** | **Power input in watts** | **Efficiency** | **Lifetime in hours** | **Cost of one bulb** |
|  | Compact Fluorescent Lamp (CFL) | 8 | 20% | 10 000 | £3.10 |
|  | Light Emitting Diode (LED) | 5 |  | 50 000 | £29.85 |

(a)     Both types of bulb produce the same useful power output.

(i)      Calculate the useful power output of the CFL. Show clearly how you work out your answer.

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Useful power output = ................................................. W

**(2)**

(ii)     Calculate the efficiency of the LED bulb. Show clearly how you work out your answer.

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Efficiency = ......................................................

**(1)**

(b)     LED bulbs are expensive. This is because of the large number of individual electronic LED chips needed to produce sufficient light from each bulb.

(i)      Use the data in the table to evaluate the cost-effectiveness of an LED bulb compared to a CFL.

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**(2)**

(ii)     Scientists are developing brighter and more efficient LED chips than those currently used in LED bulbs. Suggest **one** benefit of developing brighter and more efficient LED chips.

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**(1)**

**(Total 6 marks)**

**M1.**         (a)    (i)       

1.6 (W)

*allow* ***1*** *mark for correct substitution ie *

**2**

(ii)     

32 (%) / 0.32  
**or**their (a)(i) ÷ 5 correctly calculated

*ignore any units*

**1**

(b)    (i)       any **two** from:

•        comparison over same period of time of relative numbers of bulbs required eg over 50 000 hours 5 CFL’s required to 1 LED

*accept an LED lasts 5 times longer*

•        link number of bulbs to cost eg 5 CFL’s cheaper than 1 LED

*an answer in terms of over a period of 50 000 hours CFLs cost £15.50 (to buy), LED costs £29.85 (to buy) so CFLs are cheaper scores both marks*

*an answer in terms of the cost per hour (of lifetime) being cheaper for CFL scores 1 mark if then correctly calculated scores both marks*

•        over the same period of time LEDs cost less to operate (than CFLs)

**2**

(ii)     any **one** from:

•        price of LED bulbs will drop

*do* ***not*** *accept they become cheaper*

•        less electricity needs to be generated

*accept we will use less electricity*

•        less CO2 produced

•        fewer chips needed (for each LED bulb)

•        fewer bulbs required (for same brightness / light)

•        less energy wasted

*do* ***not*** *accept electricity for energy*

**1**

**[6]**