Energy & Efficiency Past Paper Problems

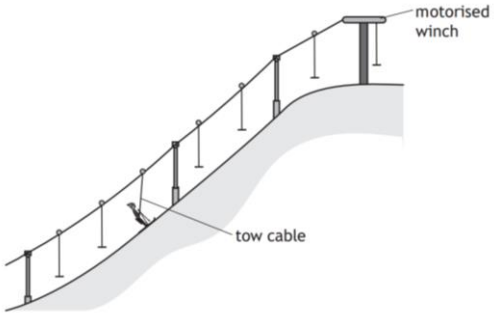
2019 Q2

1. A soldering iron and circuit board are shown below.

When the soldering iron was switched on for 270 seconds it used 6750 J of energy. Calculate the power used. **2**

2019 Q22

2. A ski tow used to move skiers to the top of a slope is shown below.



A motorised winch which is rated at 230 V, 12 A, is used in the operation of the tow.

a) **3**

i. Calculate the electrical energy used when the winch is operated for 1 minute and 20 seconds.

ii. Calculate the output energy if the system is 64% efficient. **3**

b) Explain how the efficiency of the motorised winch could be increased. **2**

2018 Q11

3. A circus acrobat on a trapeze swing is suspended high above the ground. The motion of the trapeze swing is shown below.

a) State the type of motion shown. **1**

b) The acrobat and trapeze swing have a combined mass of 69 kg.
For the acrobat and trapeze swing:

i. calculate their potential energy when they are 6·8 m above the ground; **2**

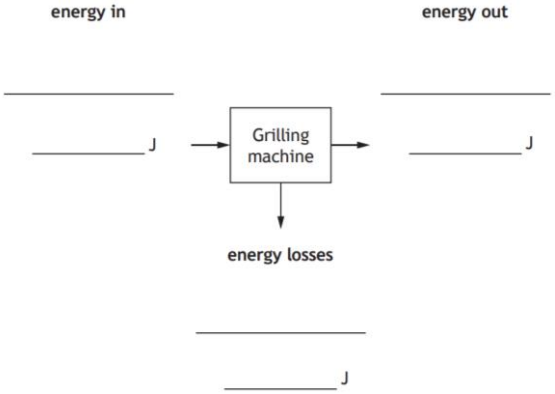
ii. calculate their velocity when their kinetic energy is 970 J. **3**

2018 Q15

4. A grilling machine is shown below.

The grilling machine has an input electrical energy of 1200 J.
Only 790 J is transformed as useful output energy in the form of heat.

a) Complete the energy audit diagram below for the grilling machine. 3
Include details of the energy forms and their values.



b) Calculate the efficiency of the grilling machine. 2

2017 Q4

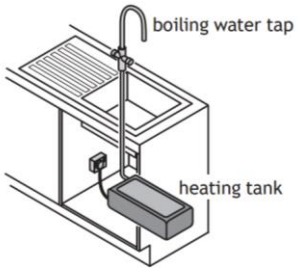
5. A 5·4 kg bowling ball travels down a lane at 8·2 ms^{-1}.

Calculate the kinetic energy of the bowling ball. 2

2017 Q10

6. A boiling water tap and heating tank is shown below. It is installed in a busy office kitchen, where 200 staff can make hot drinks throughout the day.

The boiling water tap produces boiling water instantly.



Water is boiled in the heating tank and then stored until it is ready to be used.
1·4 MJ of electrical energy is used when heating a full tank of water for the first time.

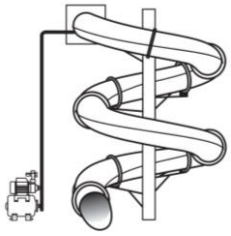
a)

i. Calculate the output energy of the system if it is 82% efficient. 3

ii. Calculate, with reference to the Data Booklet, the mass of water in a full tank when the change in temperature is 91 °C. 3

2016 Q14

7. Water is pumped to the top of a slide.



The pump used is rated at 13 A, 230 V.

a) Calculate the electrical energy supplied to the pump in one minute. 2
Show all working and final unit.

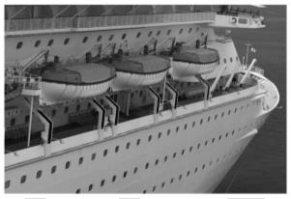
The pump was found to be 64 % efficient.

b) Calculate the output energy of the pump in one minute. 3
Show all working and final unit.

c) Explain how the efficiency of the pump could be increased. 2

2015 Q11

8. A lifeboat winching system on a cruise ship is shown below.



A lifeboat of mass 7750 kg is lowered into the water.

a) Calculate the kinetic energy of the lifeboat as it enters the water at 3 ms^{-1}. 2
Show all working and final unit.

The lifeboat is winched back up to its starting position 15 m above the water level.

b) Calculate, showing all working and final unit: 2
i. the potential energy of the lifeboat;
ii. the efficiency of the system when the input energy to the winch is 2·50 MJ. 2

c) Explain why the winching system is not 100% efficient. 2