Autumn Term 2

OLD BUCKENHAM HIGH SCHOOL

Achieving excellence together

P1 Conservation and dissipation of energy

Aiming for Grade 8

Extended Homework Assignment

Name: _____

Set: _____

Instructions

A printed copy should be handed into your teacher.

The knowledge required to complete this assignment will be supported in class in lessons of the half term.

Power and efficiency

Light bulb technology has improved considerably over the last 20 years. You may have noticed how many objects, like traffic lights, now use LEDs.

A Look at the table that shows the total power input of three different types of light bulb required to produce different light intensities. Present this data on a suitable graph.

Light intensity in lumens	Power of incandescent light lamp in W	Power of CFL (energy saving) light lamp in W	Power of LED light in W
450	40	10	7.5
800	60	15	10.0
1400	75	20	14.0
1800	100	25	18.0
2800	150	45	16.0

B Incandescent light bulbs are about 10% efficient. Use the information in the table to estimate the efficiency of CFL and LED lamps.

Questions

Energy conservation and calculations

1 List the different types of energy store, and ways of transferring energy between stores.

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..... (*2 marks*)

2 **a** Describe what we mean by 'work' in science.

..... (*1 mark*)

b Explain why when you lift an object the work done is equal to the change in gravitational potential energy, but when you push an object across a desk it is not.

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..... (*6 marks*)

3 **a** Compare the *final energy stores* between a ball which is dropped above the floor and bounces back to a portion of its original height, and another ball which is dropped and makes a crater in the sand below.

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..... (*3 marks*)

b Compare the *work done*, both for the ball which is dropped above the floor and bounces back to a portion of its original height, and for the other ball which is dropped and makes a crater in the sand below.

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..... (*6 marks*)

4 **a** Explain how to calculate the speed of a ball just before it hits the ground if it is dropped from a height of 1 m, stating any assumptions that you make.

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..... (*3 marks*)

b Use your answer to part **a** to explain why the speed of a falling object does not depend on mass.

..... (*1 mark*)

c State whether, in reality, the speed of the ball will be greater than, less than, or the same as the speed calculated and explain why.

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..... (*2 marks*)

5 A student drops a spring onto the ground and the spring compresses. The mass of the spring is 0.25 kg and the spring constant of the spring is 1 kN/m.

a Complete the table. You will need to use the equation:

elastic potential energy (E_e) = $\frac{1}{2}$ × spring constant (k) × extension^2 (e^2). (*3 marks*)

Height dropped from in m	Gravitational potential energy, E_e in J	Elastic potential energy, E_e in J	Compression of spring in m
1.00			
0.50			
0.25			

b State an assumption that you have made.

..... (*1 mark*)

Modelling energy transfer and dissipation

6 For all of the processes, some energy ends up in the surroundings.

a Name two processes that transfer energy to the surroundings.

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..... (*2 marks*)

b Explain why energy transferred to the surroundings is 'dissipated'.

..... (*1 mark*)

c Explain why the energy in the chemical store of the petrol in the fuel tank of a car that takes you to school is eventually dissipated.

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..... (*3 marks*)

Power and efficiency

7 Write down two equations that you can use to calculate power.

..... (*2 marks*)

8 **a** Complete the table by calculating the power. (*2 marks*)

Device	Energy in kJ	Time	Power
shower	60	1 minute	
refrigerator	4.8	1 day	
low-energy lamp	252	7 hours	
hairdryer	576	12 minutes	

b Complete the table and calculate the efficiency. (*4 marks*)

Device	Useful energy in J	Wasted energy in J	Total energy in J	Efficiency
light bulb	5		25	
kettle		500	2000	
television	2500	2500		
car	100		400	

c Explain how you knew how to complete the middle three columns of the table.

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..... (*2 marks*)

9 Look at the graph that you plotted for Part 3 of the Task.

a Consider an incandescent light bulb, CFL, and LED that all provide a light intensity of 1400 lumens. If an incandescent light bulb is 10% efficient calculate the useful power output of the incandescent bulb.

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..... (*2 marks*)

b **i** State and explain an assumption that you can make in order to be able to calculate the efficiencies of the other two lamps.

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..... (*2 marks*)

ii Calculate the efficiency of a CFL.

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..... (*2 marks*)

iii Calculate the efficiency of an LED.

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..... (*2 marks*)

c Suggest and explain a link between the graph and the efficiency of each lamp.

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..... (*2 marks*)

d Suggest why it may not reduce your energy bills if you replace light bulbs with energy saving devices.

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..... (*3 marks*)