Energy review - worksheet

Dr Fishwick

This worksheet contains many questions for you to practice your understanding of the energy topic. The solutions are provided after the questions. You may find it more suitable to tackle these questions in batches.

Q1

A boy kicks a football

The football has a mass of 400 g.

What is the potential energy of the football when it is 0.8 m above the ground?

Use the constant: gravitational field strength (g) = 10 N/kg.

A. 0.032 J

B. 3.2 J

C. 320 J

D. 3 200 J

Your answer:

[1]

Q2. Josh uses a new ball. He says this ball is an amazing bouncer.

He says if you drop it from **200** cm it will bounce to a height of **250** cm.

Explain why this is not possible. **[2]**

Q3.
Which wall would allow the most heat transfer through the wall?

A. Thick wall made from a material with high thermal conductivity.
B. Thick wall made from a material with low thermal conductivity.
C. Thin wall made from a material with high thermal conductivity.
D. Thin wall made from a material with low thermal conductivity.

Your answer **[1]**

Q4. A radio transfers 30 J of potential energy to 27J of useful energy.

What is the efficiency and energy loss for the radio?

	Efficiency	**Energy loss**
A	10%	3J
B	10%	27J
C	90%	3J
D	90%	27J

Your answer:

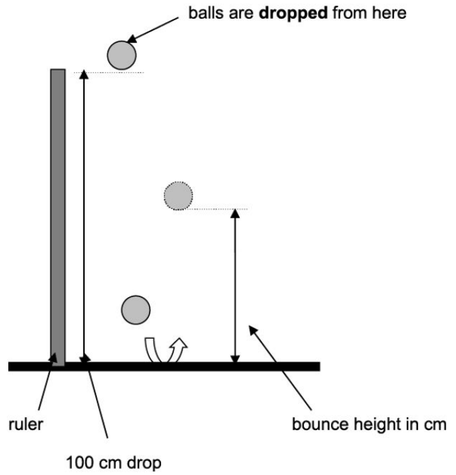
[1]

Q5. Kate investigates how well different balls bounce.

She drops different balls from the same height and measures the height the balls bounce.

She repeats the experiment 3 times for each ball.

Her results are shown in the table.



Ball	Drop height (cm)	1st reading bounce height (cm)	2nd reading bounce height (cm)	3rd reading bounce height (cm)	Mean bounce height (cm)
Red	100	75	77	73	75
Blue	100	61	62	60	61
Green	100	60	31	58	
White	100	84	86	85	85
Yellow	100	26	24		26

a) Calculate the **mean** bounce height for the **green** ball.

[1]

answer:..... cm

b) Kate missed one result for the **yellow** ball.

Calculate the **missing** result for the **yellow** ball.

answer: ..... cm **[1]**

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White	100	84	86	85	85
Yellow	100	26	24		26

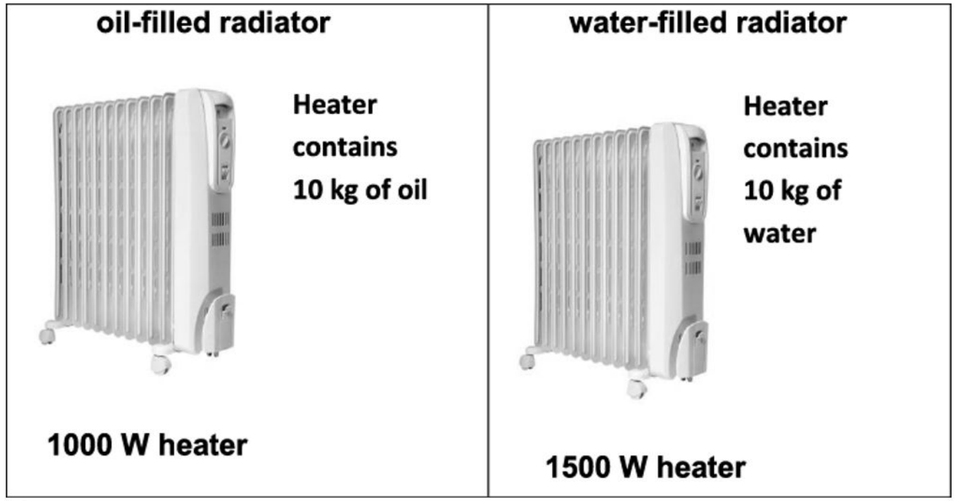
(c). Evaluate the reliability of the results

Suggest how she could have improved her experiment. **[3]**

(d). i. Kate suggests that 15% of the ball's initial energy was not transferred usefully. Use calculations to show that this is correct and suggest where the energy was transferred to. **[2]**

ii. How could the efficiency of the ball be improved? **[1]**

Q6.



a) Alex has two radiators in her home. They are filled with 10 kg of different liquids.

The table below shows information about oil and water.

Material	Specific heat capacity (J/kg°C)	Freezing point (°C)	Boiling point (°C)
Oil	1 700	−24	250
Water	4 200	0	100

Alex does a calculation.

She knows that the oil heater produces 800 J of energy each second.

Calculate the energy produced by the oil heater in 10 minutes.

Answer: .....

[2]

Material	Specific heat capacity (J/kg° C)	Freezing point (°C)	Boiling point (° C)
Oil	1 700	−24	250
Water	4 200	0	100

b) i. Alex wants the oil heater to heat up by 40°C.

How much energy is needed? Show your working.

answer: .....J **[2]**

ii. She supplies enough energy to heat up the oil radiator by 40°C but it only heats up to 32°C.

Suggest two reasons why. **[2]**

Q7.

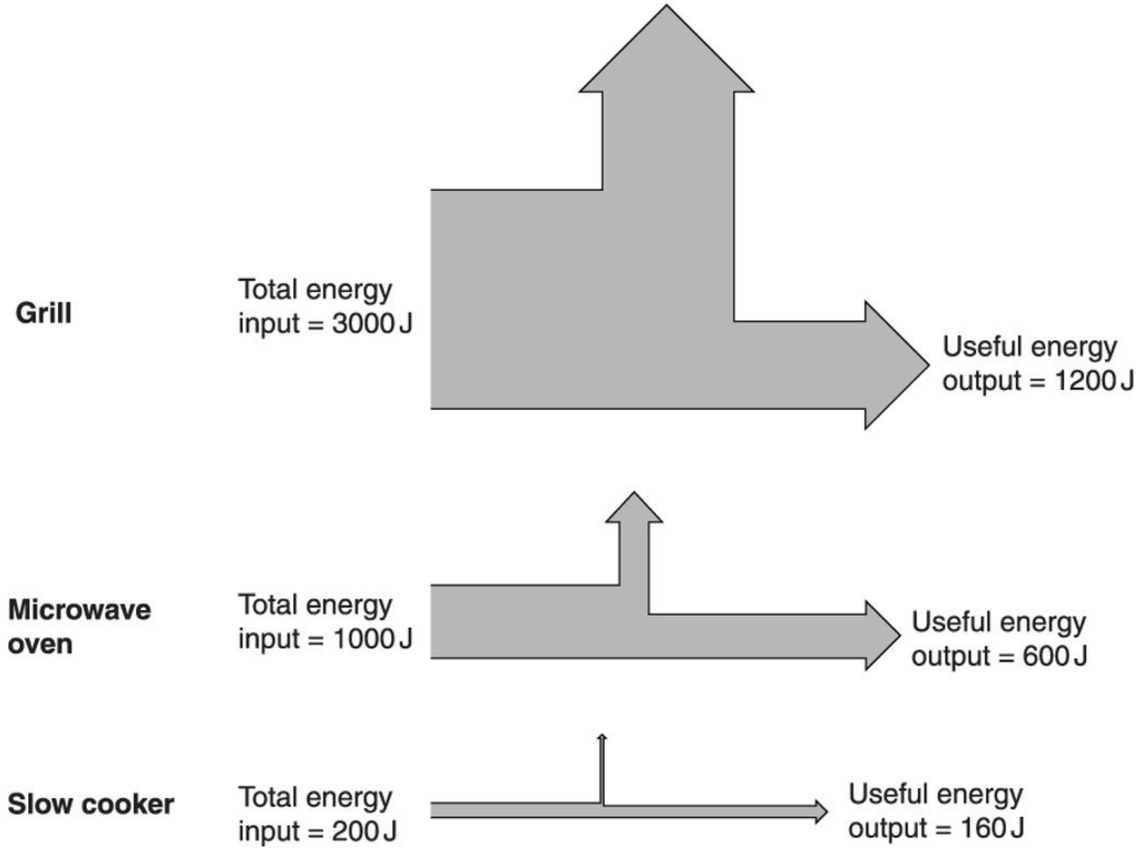
a) Radhika has many appliances in her kitchen.

She compares the efficiency of the appliances by looking at these Sankey diagrams.

Each diagram shows the energy transferred in 1 second.

Look at the Sankey diagram for the grill.

Calculate the wasted energy for the grill. **[1]**



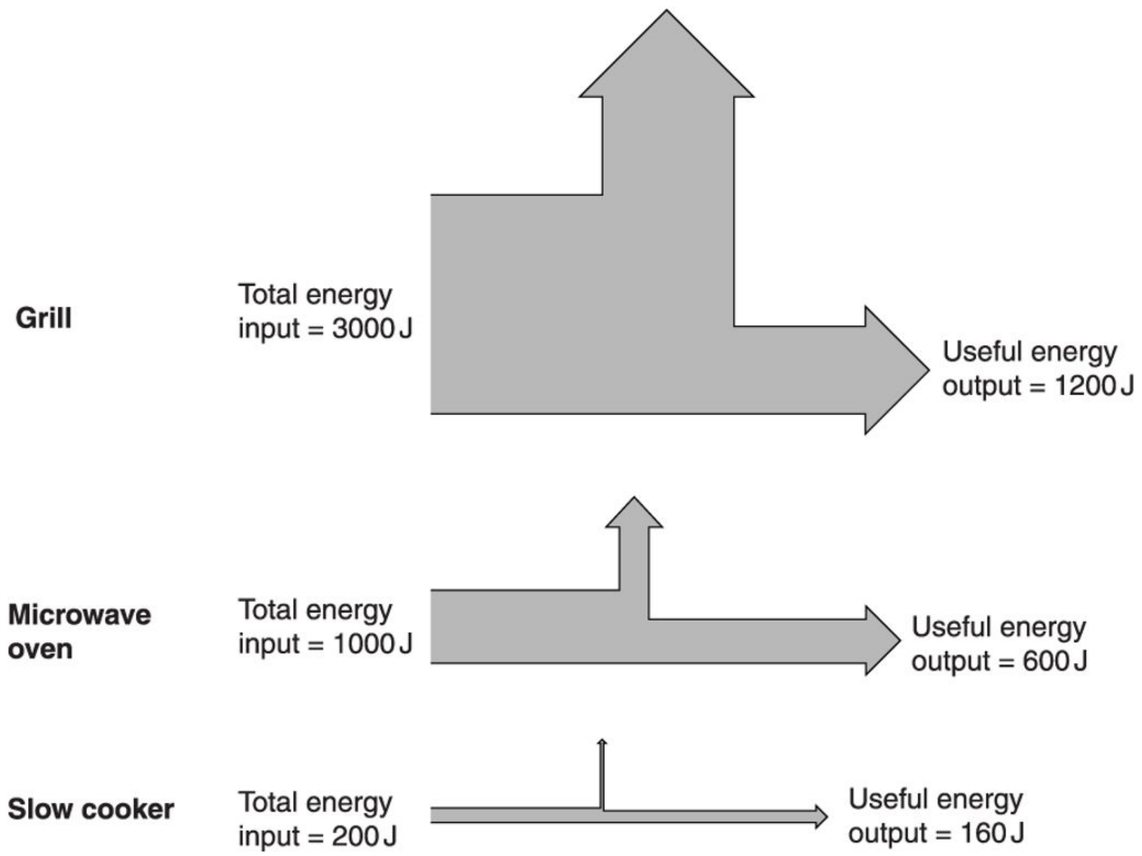
b) Calculate the efficiency of the microwave oven.

Answer:..... **[2]**

c) The slow cooker takes the l**ongest time** to cook food.

However, it is the **most efficient.**

Use the data to explain both these statements. **[3]**



Q8.

Emma drops a rock from the top of a cliff.

The rock has a mass of 0.5 kg.

As the rock falls it loses potential energy and gains kinetic energy.

The rock is travelling at a speed of 15 m / s just before it hits the ground.

Calculate the distance the rock falls.

Take the value of g to be 10 N / kg.

Ignore the effect of air resistance.

answer ..... metres

[3]

Q9.

a) Many power stations burn fuels to generate electricity.

Fuels can be renewable or non-renewable.

Wood is used in some power stations.

Why is it called a renewable fuel? **[1]**

b) Rachael has completed her homework on fuels used in power stations.

Look at her table below.

Fuel	Type
Wood	renewable
Plant and vegetable oils	renewable
Peat	non-renewable
Coal	renewable
North Sea gas	non-renewable
Uranium	renewable

She has made **two** mistakes, identify these in the table by putting a cross (**x**) next to them. **[2]**

Q10

Power generator	% Efficiency
Wind turbine farm	30
Coal power station	34
Nuclear power station	35
Oil power station	32
Gas power station	45

a) Electrical power can be generated in many ways.

Look at the data on different types of power generation.

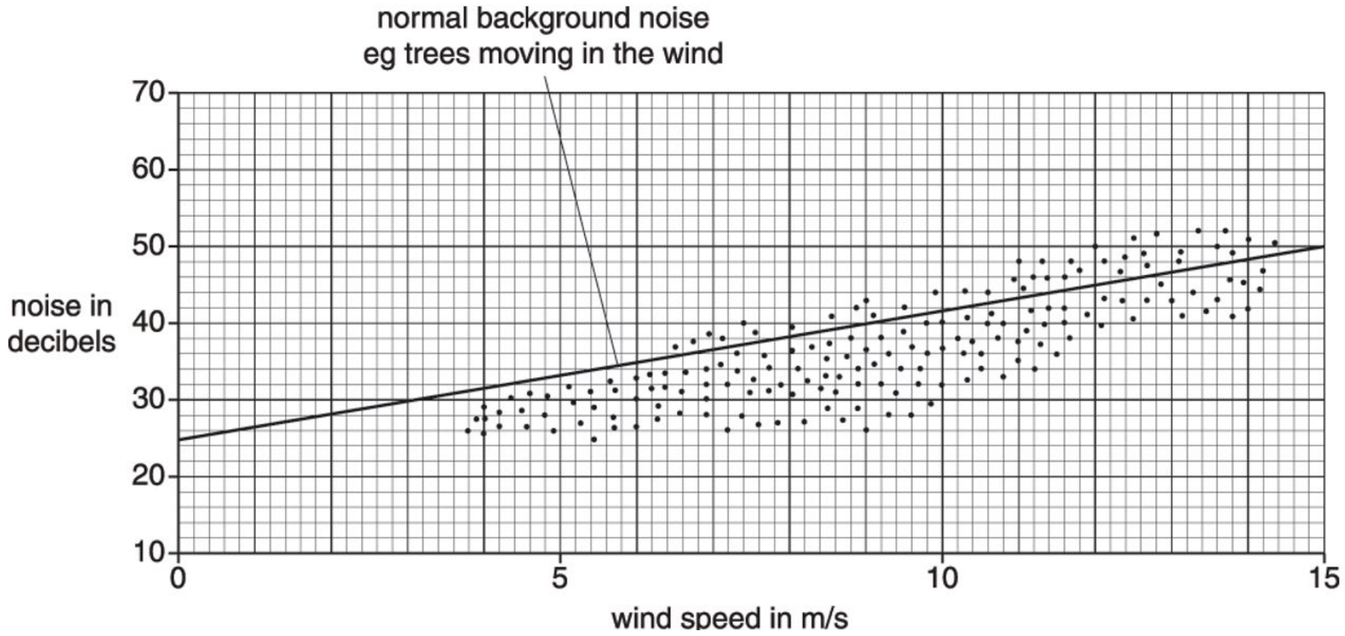
Coal, oil, gas and nuclear are all types of **thermal** power station.

Why are all these called thermal power stations? **[1]**

a) Thermal power stations are more efficient than wind turbine farms.

Suggest why wind turbine farms are often preferred to thermal power stations. **[1]**

Q11.



The people in a house are concerned about

Look at the graph.

Each dot shows a measurement of

the noise from the wind turbine.

i. Use the graph to describe how the wind turbine noise is affected by wind speed. **[1]**

ii. The mean wind speed in this area is 5 m/s.

The maximum wind speed in this area is usually less than 15 m/s.

Explain, using data from the graph, why the people in the house do not normally need to worry about the noise from the turbine. **[2]**

Answers

Question			Answer/Indicative content	Marks	Guidance
1			B	1	
			Total	**1**	
2			Idea there is fixed energy in system / can't be (more than) 100% efficient (1) Idea that extra energy is needed for this to happen (1)	2	
			Total	**2**	
3			C	1	
			Total	**1**	
4			C	1	
			Total	**1**	

Question			Answer/Indicative content	Marks	Guidance
5	a		59 (anomalous result should be left out of calculation) (1)	1	
	b		28 (1)	1	
	c		Green results unreliable / large variation / anomalous result (1) Should have repeated 31 (green) reading / other results (red, blue, white, yellow) are reliable (1) A sensible suggested improvement (1)	3	e.g. use camera to measure bounce heights (1)
	d	i	bounce height / drop height × 100% = 85% useful, therefore 15% wasted. (1) transferred to heat and sound (1)	2	
		ii	If the bounce height was greater then the efficiency would be higher / **ORA** (1)	1	
			Total	**8**	

Question			Answer/Indicative content	Marks	Guidance
6	a		Time conversion: 10 × 60 = 600 seconds (1) 800 × 600 / 480 000 (J) (1)	2	**ALLOW** 480 (kJ)
	b	i	Substitute into formula for specific heat capacity / 10 × 40 × 1 700 (1) 680 000 (J) (1)	2	**ALLOW** 680 (kJ)
		ii	Any two from: Some energy used to heat the radiator case (rather than the oil) (1) Energy passed from oil to air in room / oil undergoes cooling whilst heating up (1) Energy is dissipated to surroundings (1) It is not 100% efficient at transferring energy (1)	2	
			Total	**6**	

Question			Answer/Indicative content	Marks	Guidance
7	a		1800 (J) [1]	1	
	b		60% or 0.6 [2] if answer is incomplete or incorrect then:	2	**allow** 60 with incorrect or no unit [1] eg 60 J/s or 60 scores [1] **allow** 0.6% [1]
	c		lowest (useful) energy output / input [1]	3	**Eg.** Uses least amount of energy [1] **allow** longer time idea explained e.g. Energy = Power x time, and less power but longer time for slow cooker [1] **only** uses 160J/s (output) 200J/s (input) or **only** wastes 40J [1]
			(usefully) uses a greater proportion of energy / wastes a lower proportion of energy / AW [1]		**ignore** higher / most efficiency **allow** wastes less energy (than others) [1]
			BUT 80% or 0.8 efficient / [2]		eg **only** wastes 20% or 0.2 [2] **allow** 80 (linked to efficiency) with incorrect or no unit [1] eg. 80 J/s or 80 scores [1] **allow** 0.8% [1] evidence of the correct efficiency calculation [1] eg 160/200 [1]
			Total	**6**	

Question			Answer/Indicative content	Marks	Guidance
8			11.25 m (3) **but if incorrect** 56.25 = 5 x h (2) **but if incorrect** KE = ½ x 0.5 x 15 x 15 (1) **or** m g h = ½ m v^2 / PE = KE (1)	3	**allow** 56 = 5h (2) 11.25 (3) **if incorrect** time = 1.5 (seconds) (1) average speed = 7.5 (1) **allow** other correct calculations using equations of motion
			Total	**3**	
9	a		more can be grown / **AW** (1)	1	
	b		<table><tr><td>Coal</td><td>Renewable (x) (1)</td></tr><tr><td>Uranium</td><td>Renewable (x) (1)</td></tr></table>	2	**ALLOW** the answer to be checked on the fuel side.
			Total	**3**	

Question			Answer/Indicative content	Marks	Guidance
10	a		**Idea that:** water heated / steam is produced / fuels release heat / AW (1)	1	**allow** Heat energy is used (to produce electricity) (1) **ignore** burning Heat unqualified = 0 fuel is heated = 0
	b		renewable energy (1) less polluting gases (1) fossil fuels finite (1)	1	**allow** reduces CO_2 output / greenhouse gases (1) **allow** fossil fuels are running out (1) **allow** no fuel costs (1) **not** just environmentally friendly
			Total	**2**	

Question			Answer/Indicative content	Marks	Guidance
11		i	as wind speed increases the noise increases / ora (1)	1	
		ii	idea of: for **low** speeds / up to 5 m/s / up to mean speed - the noise level is below background / 33dB (1) idea of: for **high** speeds / above 5 m/s / above mean speed - the noise level is generally below / not much above background (1)	2	**allow** 'most dots below background (1) **eg.** 'turbine noise less than tree noise' (1) **eg** 'at high wind speeds the noise is rarely above background' (1) **allow** (if no other marks obtained) normal background is usually higher than turbine noise (1)
			Total	**3**	