Power and Efficiency (H)

1. A boiler has an input power of 12 kW from the gas it burns.

Its efficiency is 0.75.

Which row in the table shows the correct values for this boiler?

	Useful output power (kW)	Wasted output power (kW)
A	3	9
B	8	4
C	9	6
D	9	3

Your Answer ☐

[1]

2. A gas fire, used to heat a room, has an input energy transfer of 180 000 J per minute.

The fire has an efficiency of 0.8.

Use the equation: Efficiency = Useful output energy transfer / Input energy transfer

Calculate the useful output energy transfer per minute.

A 600 J
B 2400 J
C 36 000 J
D 144 000 J

Your Answer ☐

[1]

3. A pump lifts 500 kg of water to a water tank at the top of a building.

The water gains 240 000 J of gravitational potential energy.

The gravitational field strength is 10 N/kg.

Use the equation: Potential energy = Mass × Height × Gravitational field strength

Calculate the height of the water tank.

A 4.8 m
B 48 m
C 240 m
D 480 m

Your Answer

[1]

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

What is the efficiency and energy loss for the radio?

	efficiency	**energy loss**
A	10%	3 J
B	10%	27 J
C	90%	3 J
D	90%	27 J

Your answer

[1]

5. Which row **increases** the efficiency of a machine?

	increase energy losses due to friction	**increase** the work output without changing the work input
A	Yes	yes
B	Yes	no
C	No	no
D	No	yes

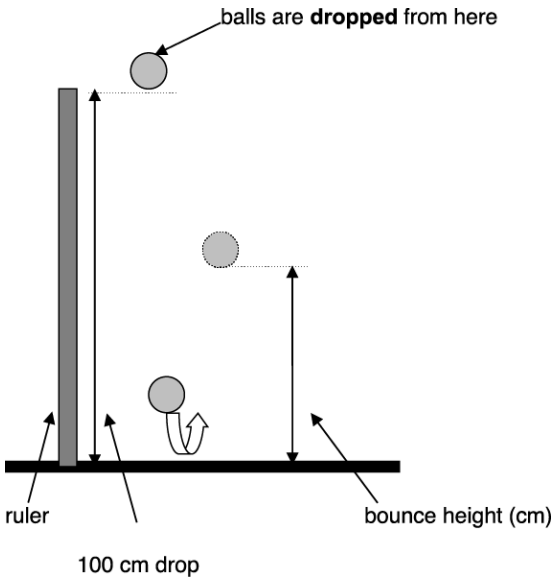
Your answer

[1]

6(a). 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)
blue	100	61	62	60	61
green	100	60	31	59	50
white	100	84	86	85	85
yellow	100	26	24		26

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

Calculate the **missing** result.

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answer: ..... cm

[1]

(b). Josh does an experiment with bouncing balls.

He does his experiment with a drop height of **200 cm**.

One ball bounces **100** cm.

Josh says that this ball is a better bouncer than any of Kate's.

Use the data and ideas about efficiency to explain why Josh is incorrect.

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[2]

7. A car rolls down a slope.

The energy at the bottom of the slope is lower than expected.

Suggest **two** ways to improve the efficiency of the roller coaster car.

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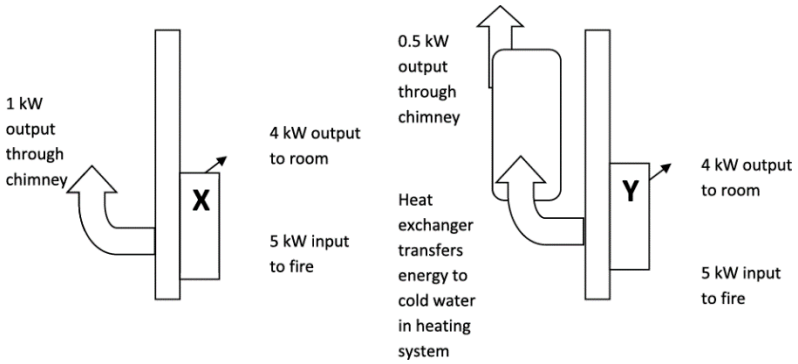
[2]

8 (a). Alex has two fires in her home, **X** and **Y** shown in the diagrams below.



Why does Fire **Y** helps save money on the energy bills for her home?
Use calculations of efficiency in your answer.

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[4]

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

The radiators have different power ratings.

oil-filled radiator	water-filled radiator
 Heater contains 10 kg of oil 400 W heater Specific heat capacity for oil is 1680 J/kg^{0}C	 Heater contains 10 kg of water 1000 W heater Specific heat capacity for water is 4200 J/kg^{0}C

The heaters are turned on and the temperature of each rises by 40 °C in 1 680 seconds.

Use the data to show that the heaters take the same time to heat up.

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[4]

9. Cars and lorries have different brakes.

Brakes absorb the energy of the vehicle before it comes to rest.

The brakes on lorries have larger brake discs and brake pads than cars.

Brakes are designed for increased air flow.

Explain why this is more important for lorries than cars.

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[4]

10. A domestic wind turbine has a power rating which varies from 1.0 kW to 3.0 kW.

i. The domestic wind turbine has an electrical resistance of 23 Ω.

It generates a current of 11 A on a windy day.

Calculate the power output in kW of the turbine on this day.

Answer = _____ kW **[4]**

ii. Suggest why the manufacturer gives a range for the power rating of the wind turbine.

_____

_____ **[1]**

iii. Using just **one** domestic wind turbine may be an unreliable source of power for a house.

State a reason why.

_____

_____ **[1]**

11. A TV works with a 12.0 V battery. It has a current of 3.19 A.

Calculate the power rating of the TV.

Power = ... W **[3]**

12 (a). Explain why the rate of cooling of a metal box is different to a cardboard box.

Assume the thickness of the walls is the same in both boxes.

---**[1]**

(b). A student investigates the rate of cooling using a cardboard box to model the walls of a building.

She puts a beaker of hot water into the cardboard box. She measures the temperature of the water every two minutes.

She investigates how the rate of cooling changes with the thickness of the walls.

Describe a method she can use to do this investigation.

---**[7]**

13 (a). Water can be heated using a 12 V heater.

A transformer is used to change a 120 V supply into 12 V.
The current in the secondary coil is 9.0 A.

Calculate the current in the primary coil.

Use an equation from the data sheet.

Current = ... A **[2]**

(b).

i. **Table 21.1** gives some information about a kettle.

Energy transferred to the kettle	525 000 J
Mass of water	1.2 kg
Starting temperature of water	25 °C
Final temperature of water	100 °C
Specific heat capacity of water	4200 J / kg °C

Table 21.1

Calculate the efficiency of the kettle described in **Table 21.1**.

Give your answer as a percentage.

Use an equation from the data sheet.

Efficiency = ... % **[5]**

ii. Explain why the efficiency of the kettle is less than 100%.

---**[1]**

END OF QUESTION PAPER