

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ apply every energy formula to unfamiliar problems
- ☐ combine two or more formulae in one question
- ☐ rearrange formulae confidently
- ☐ check answers make sense

I DO**Formulae you will need** All are in the data booklet

Energy	Formula
Work done	$E_w = Fd$
Electrical	$E_e = VIt$
Kinetic	$E_k = \frac{1}{2}mv^2$
Potential	$E_p = mgh$
Heat	$E_h = cm\Delta T$
Power	$P = E \div t$
Efficiency	$\eta = E_{out} \div E_{in}$

RememberSpecific heat capacities: water 4180, aluminium 899, copper 387, mercury 138 J/kg K. Use $g = 9.8 \text{ N/kg}$.**YOU DO****Extension questions** Work through any section. Show every step.**Work done****1 A fully loaded fishing net has a mass of 500 kg. Calculate the work done raising it 100 m.**

2 A weightlifter lifts equipment 1.2 m. The minimum work done is 600 J. Calculate the mass of the equipment.

3 A mechanic pulls a block-and-tackle rope 4 m with a force of 500 N. Calculate the work done.

4 A 50 kg mass is raised 5 m by a rope wound round a pulley on a motor shaft. Calculate the work done by the motor.

Electrical energy

5 A 12 V car battery is rated at 35 amp hours (35 A for 1 hour). Calculate the energy it can supply.

6 A generator delivers 6 kJ of energy each second at 110 V. Calculate the current.

7 A 110 V, 30 A motor uses 1.98 MJ. For how long has it been running?

8 A 230 V kettle takes 3.2 minutes to boil 1.8 litres of water from 17 °C. Calculate the current it draws, assuming no losses.

Kinetic energy

9 50 kg metal ingots move along rollers at 0.5 m/s. Calculate the kinetic energy of each ingot.

10 A 50 kg cyclist has 2.5 kJ of kinetic energy. Calculate her speed, and the kinetic energy of her 30 kg bicycle.

11 Six people with a total mass of 900 kg ride an escalator at 0.5 m/s. Calculate the average kinetic energy of each person.

12 A 10 kg radioactive-material container is crash-tested at 250 m/s in the USA and 50 m/s in the UK. Compare the kinetic energies.

Potential energy

13 A conveyor lifts a 20 kg suitcase 3.5 m into an aircraft hold. Calculate the potential energy gained.

14 At what height does a 100 kg drum have 4 kJ of potential energy?

15 A reservoir holds 1800 litres of water at a height of 260 m. Calculate the potential energy available.

16 A pile driver raised 5 m stores 9810 J. Calculate its weight and its mass.

17 A steeplejack has 2000 J of potential energy at 10 m. How much will he have at 15 m?

Heat energy

18 A hall measures 8 m × 30 m × 10 m. Air has a density of 1.3 kg/m³ and $c = 850 \text{ J/kg K}$. Calculate the heat needed to warm the air from 10 °C to 20 °C.

19 A shower element gives 7 kJ of heat each second, warming water from 15 °C to 40 °C. Estimate the flow rate and state an assumption.

20 54.3 kJ is supplied to 1.3 kg of oil ($c = 2.72 \text{ kJ/kg K}$) at 1.5 °C. Calculate its final temperature.

21 6.3×10^5 J heats a statue ($c = 3500$ J/kg K) from 16°C to 95°C . Calculate its mass.

22 2.4×10^4 J is added to 120 g of water at 19°C . Calculate its final temperature.

23 How much heat is lost when 3 kg of water cools from 80°C to 10°C ?

24 How much heat is needed to raise 0.30 kg of aluminium from 30°C to 150°C ?

25 Calculate the temperature change when 10.0 kg of water loses 232 kJ.

26 Calculate the temperature change when 1.96 kJ is added to 500 g of copper.

27 2.52×10^4 J is added to 2 kg of mercury, which reaches 130°C . What was its starting temperature?

Power

28 A winch lifts a 500 kg pallet 10 m in 15 s. Calculate the minimum output power.

29 A 3 kW heater runs for one hour. Calculate the heat energy delivered.

30 An 800 kg car reaches 70 km/h in one minute from rest. Calculate its kinetic energy and the average power needed.

Efficiency and audits

31 A 240 V, 10 A kettle takes 3 minutes to heat 0.5 kg of water from 20 °C to 100 °C. Find the energy supplied, the heat used and the efficiency.

32 Water falls 725 m through a hydroelectric station at 5125 kg/s. The station is 72% efficient. Calculate the electrical energy produced each second.

33 A lift raises 200 kg through 10 m in 2 minutes. The motor uses 12 MJ per hour. Calculate the efficiency of the lift.

34 A drinks machine heats 0.15 kg of water from 30 °C to 90 °C. The 240 V element has a resistance of 12 Ω .

a) Calculate the current drawn.

b) Calculate the heat energy transferred to the water.

c) Calculate the time taken if the system is 100% efficient.

d) It actually takes 10 s. Calculate the percentage of energy lost.

Check and reflect

Mark your answers with the answer sheet. Which “I can” statement above still needs work? Look back at the notes for that topic on the site.
