

# GCSE Combined Science: Trilogy

## Worksheet: Efficiency

|                |                   |                       |                            |
|----------------|-------------------|-----------------------|----------------------------|
| TIME<br>35 min | TOTAL<br>32 marks | CALCULATOR<br>Allowed | DIFFICULTY<br>Easy, Medium |
|----------------|-------------------|-----------------------|----------------------------|

Topics: Efficiency

|      |       |      |
|------|-------|------|
| NAME | CLASS | DATE |
|------|-------|------|

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

An electric motor is used in a toy car.

01.1

The motor is supplied with 500 J of energy. 350 J is transferred usefully to the kinetic energy store of the car.

Calculate the efficiency of the motor.

Use the equation:

efficiency = useful output energy transfer ÷ total input energy transfer

Give your answer as a decimal.

Efficiency = .....

[2 marks]

0 1 . 2

Calculate the energy wasted by the motor.

.....

.....

.....

Energy wasted = ..... J

[1 mark]

0 1 . 3

What happens to the energy wasted by the motor?

Tick (✓) **one** box.

It is destroyed.

☐

It is dissipated to the surroundings.

☐

It is stored in the battery.

☐

It is transferred to the kinetic energy store of the car.

☐

[1 mark]

0 2

An electric motor is supplied with 3500 J of energy. It transfers 2415 J of this energy usefully.

0 2 . 1

Calculate the efficiency of the motor.

Give your answer as a decimal.

Use the equation:

efficiency = useful output energy transfer ÷ total input energy transfer

.....

.....

.....

.....

Efficiency = .....

[2 marks]

0 3

A toy motor is supplied with 200 J of energy and wastes 80 J.

0 3 . 1

Calculate the efficiency of the motor.

Give your answer as a decimal.

Use the equation:

efficiency = useful output energy transfer ÷ total input energy transfer

.....

.....

.....

.....

Efficiency = .....

[2 marks]

0 4

Table 1 shows the total input energy and the useful output energy for three appliances.

Table 1

| Appliance      | Total input energy in J | Useful output energy in J |
|----------------|-------------------------|---------------------------|
| hairdryer      | 2000                    | 1800                      |
| television     | 1500                    | 450                       |
| electric drill | 600                     | 360                       |

0 4 . 1

Calculate the efficiency of the electric drill.

Use the equation:

efficiency = useful output energy transfer ÷ total input energy transfer

Give your answer as a decimal.

.....

.....

.....

.....

Efficiency = .....

[2 marks]

0 4 . 2

Which appliance wastes the most energy?

Tick (✓) **one** box.

hairdryer

☐

television

☐

electric drill

☐

[1 mark]

0 4 . 3

Which appliance is the most efficient?

Tick (✓) **one** box.

hairdryer

☐

television

☐

electric drill

☐

[1 mark]

0 5

0 5 . 1

Write down the equation that links efficiency, useful output energy transfer and total input energy transfer.

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[1 mark]

0 5 . 2

A motor has an efficiency of 40%.

What percentage of the input energy is wasted?

Tick (✓) **one** box.

20%

☐

40%

☐

60%

☐

80%

☐

[1 mark]

0 6

Table 2 shows the total input energy and the useful output energy for three kitchen appliances.

Table 2

| Appliance         | Total input energy in J | Useful output energy in J |
|-------------------|-------------------------|---------------------------|
| blender           | 1200                    | 900                       |
| vacuum cleaner    | 3000                    | 2100                      |
| hair straightener | 800                     | 680                       |

0 6 . 1

Calculate the efficiency of each appliance.  
Give each answer as a decimal.

.....

.....

.....

.....

.....

.....  
[3 marks]

0 6 . 2

State which appliance is the most efficient.

.....

.....

.....

.....  
[1 mark]

.....

0 7

An electric motor in a fan has an efficiency of 0.65.

0 7 . 1

The useful power output of the motor is 390 W.  
Calculate the total power input to the motor.

.....

.....

.....

.....

.....

Total power input = ..... W

**[3 marks]**

0 7 . 2

Calculate the power wasted by the motor.

.....

.....

.....

Power wasted = ..... W

**[1 mark]**

0 7 . 3

The fan runs for 5.0 minutes.  
Calculate the energy wasted by the motor in this time.

.....

.....

.....

.....

Energy wasted = ..... J

**[2 marks]**

0 8

An electric pump lifts water from a well to a storage tank.  
Gravitational field strength =  $9.8 \text{ N/kg}$

0 8 . 1

Calculate the increase in gravitational potential energy when  $0.80 \text{ kg}$  of water is lifted through a height of  $12 \text{ m}$ .

.....

.....

.....

.....

Increase in gravitational potential energy = ..... J

[2 marks]

0 8 . 2

The pump lifts  $0.80 \text{ kg}$  of water through  $12 \text{ m}$  every second. The total power input to the pump is  $150 \text{ W}$ .  
Calculate the efficiency of the pump.  
Give your answer as a decimal.

.....

.....

.....

.....

Efficiency = .....

[2 marks]

0 8 . 3

Give **one** way that energy is wasted by the pump.

.....

.....

[1 mark]

0 9

An electric kettle has an efficiency of 94%. Its useful power output is 2632 W.

0 9 . 1 Calculate the total power input to the kettle.

.....

.....

.....

.....

.....

Total power input = ..... W

[3 marks]

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**END OF QUESTIONS**

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

# Mark scheme

## GCSE Combined Science: Trilogy · Worksheet: Efficiency · 32 marks

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### Question 1 (4 marks)

#### 01.1 [2 marks]

**Answer:** 0.70

- $\text{efficiency} = 350 \div 500$  (1)
- $\text{efficiency} = 0.70$  (1)

**Notes:** An answer of 70% scores 1 mark (the answer must be given as a decimal).

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#### 01.2 [1 mark]

**Answer:** 150 J

- 150 (J) (1)
- 

#### 01.3 [1 mark]

**Correct:** It is dissipated to the surroundings.

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### Question 2 (2 marks)

#### 02.1 [2 marks]

**Answer:** 0.69

- $\text{efficiency} = 2415 \div 3500$  (1)
- $\text{efficiency} = 0.69$  (1)

**Notes:** An answer given as a percentage (69%) scores 1 mark.

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### Question 3 (2 marks)

#### 03.1 [2 marks]

**Answer:** 0.60

- $\text{useful energy} = 200 - 80 = 120$  (J) (1)
- $\text{efficiency} = 120 \div 200 = 0.60$  (1)

**Notes:** An answer of 0.40 ( $80 \div 200$ ) scores 0 marks.

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## Question 4 (4 marks)

### 04.1 [2 marks]

**Answer:** 0.60

- efficiency =  $360 \div 600$  (1)
- efficiency = 0.60 (1)

**Notes:** An answer of 60% scores 1 mark (the answer must be given as a decimal).

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### 04.2 [1 mark]

**Correct:** television

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### 04.3 [1 mark]

**Correct:** hairdryer

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## Question 5 (2 marks)

### 05.1 [1 mark]

**Answer:** efficiency = useful output energy transfer  $\div$  total input energy transfer

- efficiency = useful output energy transfer  $\div$  total input energy transfer (1)
- 

### 05.2 [1 mark]

**Correct:** 60%

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## Question 6 (4 marks)

### 06.1 [3 marks]

**Answer:** Blender 0.75; vacuum cleaner 0.70; hair straightener 0.85

- blender efficiency =  $900 \div 1200 = 0.75$  (1)
  - vacuum cleaner efficiency =  $2100 \div 3000 = 0.70$  (1)
  - hair straightener efficiency =  $680 \div 800 = 0.85$  (1)
- 

### 06.2 [1 mark]

**Answer:** The hair straightener

- hair straightener (1)

**Notes:** Allow ECF from the previous part.

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## Question 7 (6 marks)

### 07.1 [3 marks]

**Answer:** 600 W

- $0.65 = 390 \div P_{\text{in}}$  (1)
- $P_{\text{in}} = 390 \div 0.65$  (1)
- $P_{\text{in}} = 600$  (W) (1)

**Notes:** An answer of 600 W scores 3 marks. An answer of 253.5 (W) scores 0 marks.

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### 07.2 [1 mark]

**Answer:** 210 W

- $600 - 390 = 210$  (W) (1)

**Notes:** Allow ECF from the previous part.

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### 07.3 [2 marks]

**Answer:** 63 000 J

- $E = 210 \times 300$  (1)
- $E = 63\,000$  (J) (1)

**Notes:** Allow ECF. An answer of 1050 (J) (time in minutes) scores 1 mark.

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## Question 8 (5 marks)

### 08.1 [2 marks]

**Answer:** 94.08 J

- $E_p = 0.80 \times 9.8 \times 12$  (1)
- $E_p = 94.08$  (J) (1)

**Notes:** Allow 94 (J).

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### 08.2 [2 marks]

**Answer:** 0.63

- $\text{efficiency} = 94.08 \div 150$  (1)
- $\text{efficiency} = 0.63$  (1)

**Notes:** Allow 0.627. An answer of 63% scores 1 mark (the answer must be given as a decimal). Allow ECF from the previous part.

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### 08.3 [1 mark]

**Answer:** Friction in the moving parts heats the pump / sound / heating of the motor wires.

- friction (in moving parts) heats the pump / surroundings / sound / heating of the wires in the motor / energy transferred to the kinetic store of the water (1)
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## Question 9 (3 marks)

### 09.1 [3 marks]

**Answer:** 2800 W

- $0.94 = 2632 \div P_{\text{in}}$  (1)
- $P_{\text{in}} = 2632 \div 0.94$  (1)
- $P_{\text{in}} = 2800$  (W) (1)

**Notes:** An answer of 2474.08 (W), from multiplying by the efficiency, scores 0 marks.

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