You may cut this homework page out if you are not taking your booklet home

FULL NAME ................................................................. DUE DATE ......................................................

SCIENCE CLASS .......................... TEACHER ..................................................................

# Combined Sciences: Physics Homework/Extension Sheet T2pt1.2

**1**. Which of the following is the typical speed of a car on a motorway?

(1 mark)

- ☐ **A:** 3.1 m/s
- ☐ **B:** 6 m/s
- ☐ **C:** 10.5 m/s
- ☐ **D:** 31 m/s

**2**. It takes a trolley 25 ms to pass through a light gate. How long is this in seconds?

(1 mark)

- ☐ **A:** 0.00025 s
- ☐ **B:** 0.025 s
- ☐ **C:** 2.5 s
- ☐ **D:** 25000 s

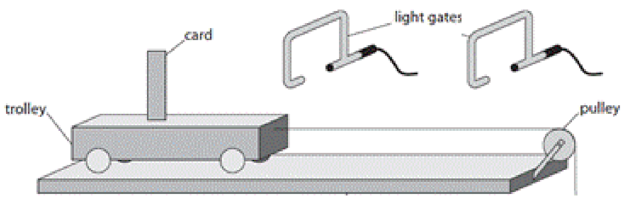
**3**. If a cat walked 200 m in 4 minutes what was its average speed?

Use s = d ÷ t

(2 marks)

- ☐ **A:** 0.83 m/s
- ☐ **B:** 50 m/s
- ☐ **C:** 0.84 m/s
- ☐ **D:** 0.02 m/s

**4**. A teacher investigates the motion of a trolley along a horizontal runway using the apparatus shown to the right.




The scientist can measure several quantities in the analysis.

(a) State and explain whether velocity is a scalar quantity or a vector quantity

(2 marks)

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(b) The trolley passes through the first light gate with a velocity of 0.41 m/s.
The trolley passes through the second light gate with a velocity of 0.62 m/s.
The time it takes for the card on the trolley to travel between the two light gates is 0.38 s.
Calculate the acceleration of the trolley

(3 marks)

acceleration = ..................... $m/s^2$

(c) The investigation is repeated with a lighter trolley.
The card on top of the trolley took 0.095 s to pass through the first light gate.
The card on top of the trolley was 6 cm wide.
Calculate the average speed, in m/s, of the trolley when it went through the first light gate.

(2 marks)

speed of trolley through first light gate = ..................... m/s

| | | |
|---|---|---|
| | distance travelled = average speed × time | |
| | acceleration = change in velocity ÷ time taken | $a = \frac{(v-u)}{t}$ |
| | force = mass × acceleration | $F = m \times a$ |
| | weight = mass × gravitational field strength | $W = m \times g$ |
| **HT** | **momentum = mass × velocity** | $\boldsymbol{p = m \times v}$ |
| | change in gravitational potential energy = mass × gravitational field strength × change in vertical height | $\Delta GPE = m \times g \times \Delta h$ |
| | kinetic energy = 1/2 × mass × (speed)$^2$ | $KE = \frac{1}{2} \times m \times v^2$ |
| | efficiency = $\frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$ | |
| | wave speed = frequency × wavelength | $v = f \times \lambda$ |
| | wave speed = distance ÷ time | $v = \frac{x}{t}$ |
| | work done = force × distance moved in the direction of the force | $E = F \times d$ |
| | power = work done ÷ time taken | $P = \frac{E}{t}$ |
| | energy transferred = charge moved × potential difference | $E = Q \times V$ |
| | charge = current × time | $Q = I \times t$ |
| | potential difference = current × resistance | $V = I \times R$ |
| | power = energy transferred ÷ time taken | $P = \frac{E}{t}$ |
| | electrical power = current × potential difference | $P = I \times V$ |
| | electrical power = (current)$^2$ × resistance | $P = I^2 \times R$ |
| | density = mass ÷ volume | $\rho = \frac{m}{V}$ |

| | | |
|---|---|---|
| | force exerted on a spring = spring constant × extension | $F = k \times x$ |
| | (final velocity)$^2$ – (initial velocity)$^2$ = 2 × acceleration × distance | $v^2 - u^2 = 2 \times a \times x$ |
| **HT** | **force = change in momentum ÷ time** | $\boldsymbol{F = \frac{(mv - mu)}{t}}$ |
| | energy transferred = current × potential difference × time | $E = I \times V \times t$ |
| **HT** | **force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length** | $\boldsymbol{F = B \times I \times l}$ |
| | For transformers with 100% efficiency, potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil | $V_P \times I_P = V_S \times I_S$ |
| | change in thermal energy = mass × specific heat capacity × change in temperature | $\Delta Q = m \times c \times \Delta\theta$ |
| | thermal energy for a change of state = mass × specific latent heat | $Q = m \times L$ |
| | energy transferred in stretching = 0.5 × spring constant × (extension)$^2$ | $E = \frac{1}{2} \times k \times x^2$ |

**Metric prefixes**

| how to convert | abbreviation | prefix |
|---|---|---|
| x 1000 ↓ | **T** | tera- |
| x 1000 ↓ | **G** | giga- |
| x 1000 ↓ | **M** | mega- |
| x 1000 ↓ | **k** | kilo- |
| | no prefix | |
| ÷ 1000 ↑ | **m** | milli- |
| ÷ 1000 ↑ | **µ** | micro- |
| ÷ 1000 ↑ | **n** | nano- |
| ÷ 1000 ↑ | **p** | pico- |

**Time**

| how to convert | abbreviation | Unit of time |
|---|---|---|
| x 7 ↓ | **wk** | week |
| x 24 ↓ | **d** | day |
| x 60 ↓ | **h or hr** | hour |
| x 60 ↓ | **min** | minute |
| | **s, seconds** | |
| ÷ 1000 ↑ | **ms** | millisecond |
| ÷ 1000 ↑ | **µs** | microsecond |
| ÷ 1000 ↑ | **ns** | nanosecond |
| ÷ 1000 ↑ | **ps** | picosecond |