| Name: | | Date: | |
|---|---|---|---|

# P13 1 The Electromagnetic Spectrum

Worksheet Grade

Current ⇒ Target

**Key Questions**

- What are the parts of the electromagnetic spectrum (EMS)
- Range of wavelengths in the EMS that an eye can detect
- How energy is transferred by electromagnetic waves

**Lesson Objective**

To understand the spectrum of electromagnetic waves and how they transfer energy.

| **Route to Learning** | Grade | Achieved |
|---|---|---|
| State that all EM waves travel at the same speed in a vacuum | 4 | |
| Identify the position of EM waves in the spectrum in order of wavelength and frequency. | 5 | |
| Describe the relationship between the energy being transferred by an EM wave and the frequency of the wave. | 6 | |
| Explain why the range of EM wavelengths detected by the human eye is limited. | 7 | |
| Use standard form in calculations of wavelength, frequency, and wave speed. | 8 | |

What type of wave is Light and what does it transfer? **Grade 2-3**

What can travel across a vacuum and does it have mass?

Complete the sentence **Grade 1-2**

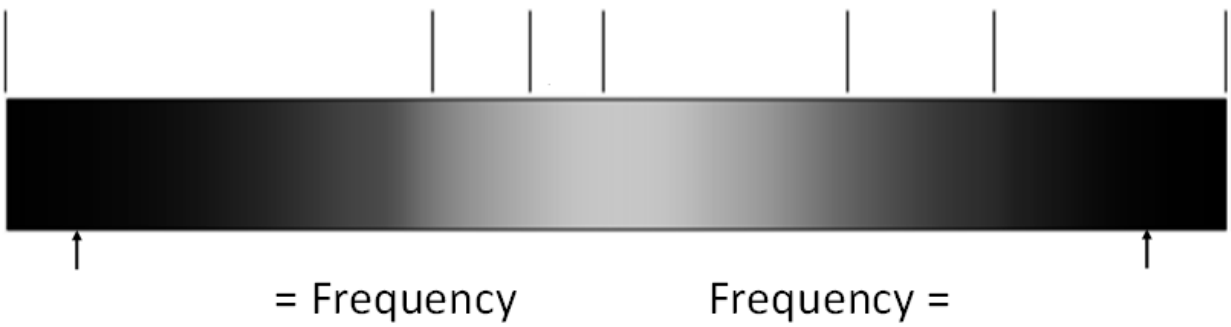
Light is an _____ electric and _____ field transferring _____

from a _____ (e.g. Sun, Light Bulb) to an _____ (e.g. Black blazer, Green Grass).

The combined oscillating _____ and magnetic _____ is called _____ .

What travels at the speed of light in a vacuum? **Grade 3-4**

Complete the labelling **Grade 1-2**



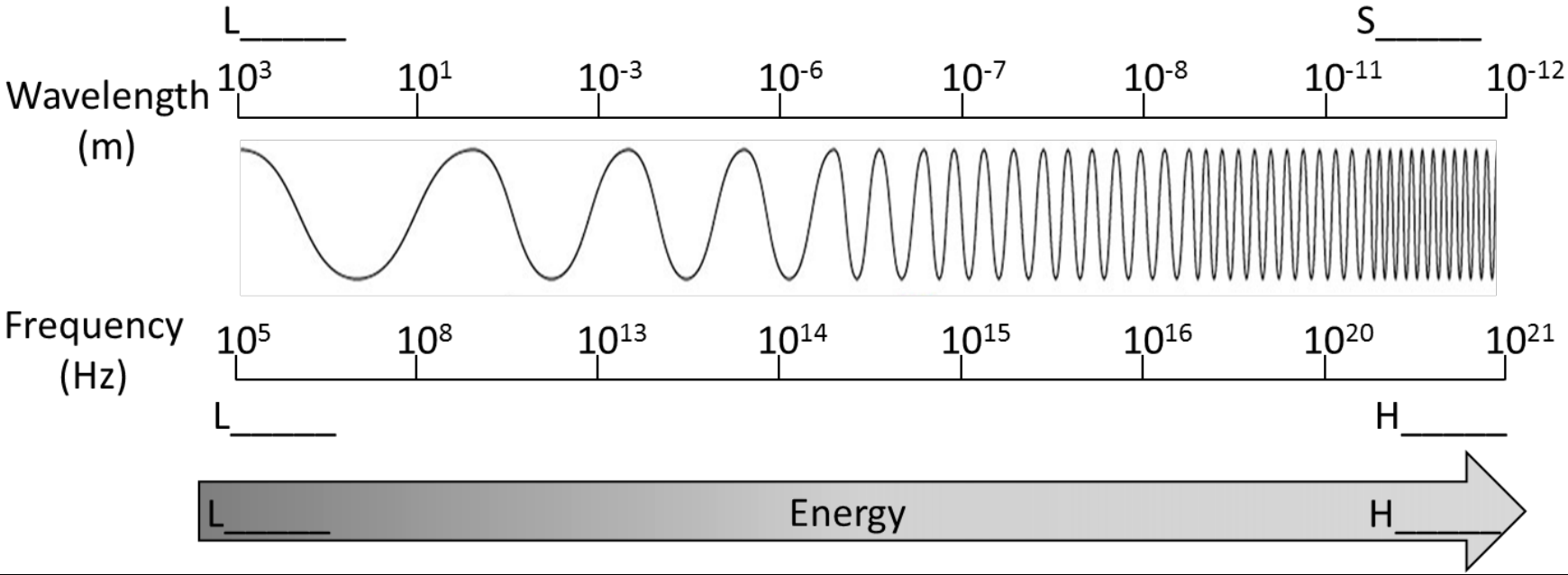
Complete the missing information for the Electromagnetic Spectrum (EMS)

| EM Banding | R……. ……. | M……. ……. | I……. ( ) | V……. ……. | U……. ( ) | X……. ……. | G……. ……. |
|---|---|---|---|---|---|---|---|
| Usage Example | | | | | | | |
| Wavelength Size Example | | | | | | | |

Grade 1-2

Grade 4-5

Grade 3-4




**Extension:** Describe how night vision works

Grade 4-5

| Describe the relationship between the energy transferred by an EM wave and the frequency of the wave |
|---|
| |
| |

Grade 5-6

| Describe how the eye sees movement and colour |
|---|
| |
| |

Grade 4-5

| Explain why the range of EM wavelengths detected by the human eye is limited. |
|---|
| |
| |
| |
| |

Grade 6-7

| Write the numbers in standard form | | Write the numbers in the normal format | |
|---|---|---|---|
| 120,000,000 | | $8x10^{-6}$ | |
| 0.000,000,456 | | $4x10^{3}$ | |
| 936000000000000 | | $4.67x10^{-8}$ | |
| 0.0000000029 | | $92.6x10^{12}$ | |
| 469200000000000000.0 | | $0.74x10^{-6}$ | |

Grade 4-5

Calculate the missing value and write the answers in standard form $v = f \times \lambda$

| **Wave Speed m/s** | **Frequency Hz** | **Wavelength m** |
|---|---|---|
| | $170x10^{6}$ | $1x10^{-3}$ |
| | $75x10^{8}$ | $56x10^{-6}$ |
| | $0.04x10^{8}$ | $2.1x10^{-7}$ |
| $3x10^{8}$ | | $390x10^{-9}$ |
| $3x10^{8}$ | | $7000x10^{-10}$ |
| $270x10^{6}$ | $456x10^{15}$ | |
| $0.45x10^{10}$ | $86.5x10^{14}$ | |

Grade 6-7

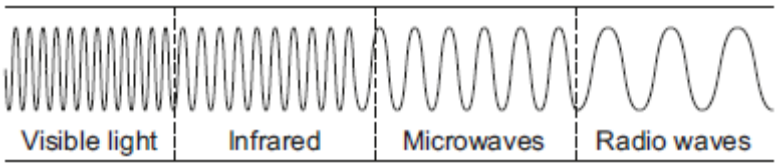
| **Extension:** | |
|---|---|
| A green laser is fired through water at a frequency of $560x10^{12}$ Hz and wavelength of $401x10^{-9}$ m. What's the speed of light in water? | |
| Light from a distant star shines red ($450x10^{12}$Hz) and blue ($650x10^{12}$Hz). What's the difference in wavelength between the two colours? | |

Grade 7-8

| What is the wavelength? | Grade 7-8 |
|---|---|
|  Frequency is $2.45 \times 10^9$Hz |  Frequency is $5 \times 10^9$Hz |
| Show your calculations | Show your calculations |

**Exam Questions:**

Infrared and microwaves are two types of electromagnetic radiation. The diagram below shows the positions of the two types of radiation within part of the electromagnetic spectrum.




(a) Name **one** type of electromagnetic radiation which has more energy than infrared.

_____

**(1)**

(b) Use the correct answer from the box to complete each sentence. Each answer may be used once, more than once or not at all.

| greater than | less than | the same as |
|---|---|---|

The wavelength of infrared is _____ the wavelength of microwaves.

The frequency of microwaves is _____ the frequency of infrared.

The speed of microwaves in a vacuum is _____ the speed of infrared in a vacuum.

**(3)**

(c) Some of the properties of infrared and microwaves are the same.

State **two** of these properties.

1. _____

_____

2. _____

_____

**(2)**