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Name : ______
Date:

Combined Sciences (Physics): Electromagnetic Spectrum

1. <u>Electromagnetic Spectrum</u>

 Lowest Frequency
 Highest Frequency

 radio
 Visible
 Ultraviolet

 Gamma

Highest Wavelength -

A) Properties of Electromagnetic Waves

- All are transverse waves
 - Electric and magnetic fields oscillate at 90°.
- Transfer energy from one place to another
- Do not require any medium to travel from one place to another (can travel through vacuum).
- Travel at speed of 3×10^8 m/s in vacuum.
 - Wave velocity is the product of frequency and wavelength ($v = f\lambda$)
 - Frequency does not change when travelling from one medium to another.
- Obey law of reflection and refraction



Lowest Wavelength

Component	Use
	- Radio broadcasting
Radio waves	- Navigation system
	- Telecommunications
Microwayo	- Satellite TV
Microwave	- Microwave oven
Infrared	- Remote controllers
minared	- Infrared radiation sensors (security alarms)
Visible light	- Optical fibres
LIV	- Sun bedding – Artificial tanning
0.4	- Sterilisation devices
Y roy	- X-ray scanners for security
A-lay	- Medical X-ray imaging
Gamma ray	- Radiation therapy in cancer treatment

B) Uses of Electromagnetic Waves

C) Summary



INCREASING WAVELENGTH



Name : _____

Date:				

Electromagnetic Spectrum (Worksheet 1)

Difficulty: Easy

- 1. The diagram below shows the components of the electromagnetic spectrum
 - (a) Identify the components of the electromagnetic spectrum.

Lowest Frequen	су			est Frequency
radio waves			X-ray	
Highest Waveler	igth		→ Lowes	st Wavelength
(b) The electron	nagnetic waves are what typ	e of wave? :		
(c) Can electror	nagnetic waves travel in vac	euum?		Yes / No
(d) What is the	speed electromagnetic wave	s in vacuum? :		m/s

2. Identify the use of each component of the electromagnetic spectrum.

Component	Use
Radio waves	
$\nabla \gamma$	
Y	
X-ray	



Name : _____

Date: _____

Electromagnetic Spectrum (Worksheet 2)

Paper 1 : MCQ

- 1. Which list of 3 electromagnetic waves is arranged in the correct order of decreasing wavelength?
 - A. microwaves, infra-red radiation, visible light
 - B. microwaves, ultraviolet radiation, infra-red radiation
 - C. X-rays, ultra-violet radiation, gamma rays
 - D. X-rays, ultra-violet radiation, microwaves
- 2. Which component in the electromagnetic spectrum is used to sterilise surgical equipment?
 - A. gamma rays
 - B. microwaves
 - C. radio waves
 - D. ultra-violet
- 3. A woman sits in the Sun.



Which statement related the electromagnetic spectrum is not correct?

- A. she feels warm because of microwaves radiation from the surrounding
- B. she can hear the radio broadcast because of the radio waves transmitted from radio station
- C. she can see the sailboat in the sea because of the visible light from the Sun
- D. she gets a suntan because of the ultraviolet radiation from the Sun

- 4. A type of electromagnetic radiation possesses the following properties.
 - harmful to the human body.
 - its frequency is higher than the frequency of ultra-violet radiation.
 - it is not detected by the human eye.

What is this radiation?

- A. gamma rays
- B. microwaves
- C. light
- D. radio waves
- 5. How do the wavelength, frequency and speed of gamma radiation compare with that of ultraviolet radiation in a vacuum?

	wavelength	frequency	speed
А	longer	lower	same
В	longer	lower	lower
С	shorter	higher	lower
D	shorter	higher	same

6. Which row does **not** match the component of the electromagnetic spectrum with its use?

	component	use
А	microwaves	satellite transmission
В	visible light	photography
С	gamma-rays	medical treatment
D	X-rays	radio communication

- 7. Which of the following electromagnetic waves is commonly used in satellite communications?
 - A. infra-red waves
 - B. microwaves
 - C. radio waves
 - D. x-rays

8. The diagram below shows the electromagnetic spectrum of the electromagnetic waves in order.

Which of the waves (A, B, C or D) is used for artificial sun tanning?

Gamma A Ray	В	С	D		Radio Wave
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9. The figure shows the electromagnetic spectrum.

Gamma rays	М	Ultra violet rays	Ν	0	Microwaves	Ρ
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Which part of the spectrum is found in region O?

- A. infra-red radiation
- B. radio waves
- C. visible light
- D. X-rays
- 10. Which is an application of microwaves
 - A. Used in global positioning system (GPS) to communicate with satellites
 - B. Used in scanning of luggage
 - C. Used in treatment of cancer
 - D. Used in TV-remote controllers
- 11. Radio waves, infrared waves and ultra-violet radiation are all part of the electromagnetic spectrum.

What is the correct order of increasing wavelength?

	shortest		longest
Α	radio waves	infra-red radiation	ultra-violet radiation
в	radio waves	ultra-violet radiation	infra-red radiation
С	ultra-violet radiation	infra-red radiation	radio waves
D	ultra-violet radiation	radio waves	infra-red radiation

- 12. Which of the following is **not** an application of electromagnetic waves?
 - A. Sonar system C. Infrared system for night navigation
 - B. Radar system D. Wireless telecommunication system

13. Which of the following devices does not make use of electromagnetic waves in its operation?

- A. A camera C. Loudspeaker
- B. A radio set D. A television set
- 14. The diagram shows different regions of the electromagnetic spectrum.

Gamma rays	x	Visible light		Y	Radio waves
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What regions do X and Y represent?

	Χ	Y
A.	Ultraviolet	Infrared
B.	Infrared	X-ray
C.	X-ray	Microwave
D.	Ultraviolet	Microwave

- 15. Which of the following sets of electromagnetic waves have higher frequencies than the visible light?
 - A. Radio waves, infrared radiation, ultraviolet radiation.
 - B. Radio waves, microwaves, infrared radiation.
 - C. X-ray, gamma rays, ultraviolet radiation.
 - D. X-ray, microwaves, infrared radiation.

16. The table shows the electromagnetic spectrum of the electromagnetic waves.

Gamma Ray	A	В	С	D		Radio Wave
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Which of the waves (A, B, C or D) is used in sunbeds and sterilizing of medical equipment?

17. From the electromagnetic spectrum shown, compare the wavelength, frequency and speed of P and Q in vacuum.

ultraviolet P	infrared	Q
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	wavelength	frequency	speed
Α	$\lambda_p < \lambda_Q$	$f_p > f_Q$	$v_p > v_Q$
В	$\lambda_p > \lambda_Q$	$f_p < f_Q$	$v_p < v_Q$
С	$\lambda_p < \lambda_Q$	$f_p > f_Q$	$v_p = v_Q$
D	$\lambda_p > \lambda_Q$	$f_p < f_Q$	$v_p = v_Q$

- 18. Which of the following correctly lists three components of electromagnetic spectrum in order of decreasing frequency?
 - A. gamma rays, visible light, microwaves
 - B. gamma rays, microwaves, visible light
 - C. microwaves, gamma rays, visible light
 - D. microwaves, visible light, gamma rays

Paper 2 : Structured Questions

1. A car passes through an average speed camera system as shown in Fig. 1.1.



Fig 1.1

The average speed camera system makes use of some of the following electromagnetic waves:

gamma rays infrared waves microwaves X-rays ultraviolet rays

State

- (a) which wave is used to detect the vehicle at the entry and exit points of the enforcement zone,
- (b) which wave is used to wirelessly transmit data between Camera 1 and Camera 2,
- (c) one property of electromagnetic waves that make them suitable to be used in the average speed camera system.