Grade 10 Science Reviewer -2nd Quarter Cheat Sheet

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Pioneers of Electromagnetism

Scientist	Contribution	Key Concept
Hans Christian Oersted	Discovered that an electric current produces a magnetic field.	Electromagnetism link
André-Marie Ampère	Developed the mathematical relationship between electric current and the magnetic field (Ampère's Law).	Direction of Current
Michael Faraday	Discovered electromagnetic induction (a changing magnetic field produces an electric current). Invented the electric motor/generator principle.	Electromagnetic Induction
James Clerk Maxwell	Mathematically predicting EM waves and confirming light is an EM wave.	Unified Theory of Electromagnetism
Heinrich Hertz	Experimentally confirmed Maxwell's predictions by generating and detecting Radio Waves in his lab.	Experimental Confirmation of EM Waves

⚡ Electromagnetic Waves

EM Waves are disturbances that propagate through space and matter, transferring energy. They are produced by the vibration or acceleration of charged particles.

Nature: They are transverse waves (vibrations are perpendicular to the direction of wave travel) and are non-mechanical (don't require a medium, can travel in a vacuum).

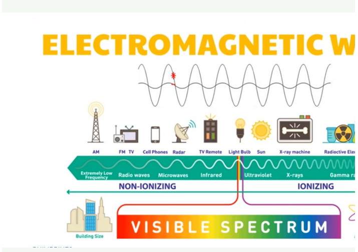
Speed: All EM waves travel at the same speed in a vacuum: the Speed of Light (c = approx. 3.0 x 10^8 m/s.

Electric Field (*E*) and **Magnetic Field** (*B*) are perpendicular to each other and to the direction of wave propagation.

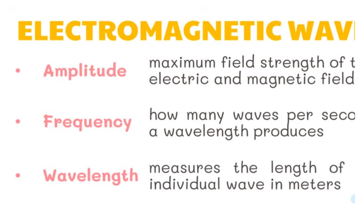
Electromagnetic Spectrum

EM Wave	Practical Uses
Radio Waves	Communication (AM/FM), TV, MRI, Radar
Microwaves	Cooking, Satellite communication, GPS, Wi-Fi
Infrared	Remote controls, Thermal imaging, Night vision, Heaters, Camera Autofocusing
Visible Light	Seeing, Photosynthesis, Fiber Optics
Ultraviolet Rays	Sterilization, Tanning beds, Checking Bankbook signature, Detecting counterfeit money
X-Rays	Medical imaging, Security scans
Gamma Rays	Cancer treatment (radiotherapy), Sterilization of equipment, Checking inside of steel oil pipe, Water sterilization

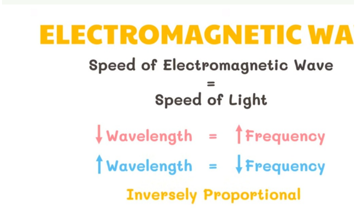
The Electromagnetic Spectrum



Properties of EM Waves



Characteristics of EM Waves



Law of Reflection

Law of Reflection

1. The incident ray, the reflected ray, and the normal (a line perpendicular to the surface at the point of incidence) all lie in the same plane.

Law of Reflection (cont)

2. The angle of incidence (Angle i) is equal to the angle of reflection (Angle r).

Images on Plane Mirrors

Location: distance from mirror to image is equal to distance from mirror to object.
Orientation: always *upright*
Size: same size as the object
Type: always *virtual*
- Image formed in a plane mirror is **Laterally Inverted** - left and right are switched.
Multiple Reflections
To calculate the number of images that are formed we place the plane mirrors tilted at an angle to each other, using the formula:
$N = (360/angle) - 1$
where: N is the number of images formed.
If the mirrors are parallel (facing each other), they form an infinite number of images.

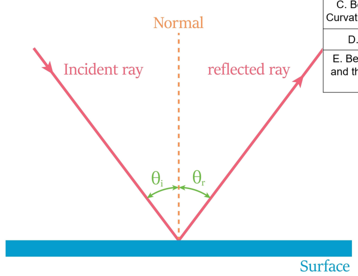
Curved Mirrors / Spherical Mirrors

Concave / Converging Mirror	Curves inward (like an inverted C)	Depends on object position; can be Real/Virtual, Inverted/Upright, Magnified/Reduced
Convex / Diverging Mirror	Curves outward (like the letter C))	Always **Virtual**, **Upright**, and **Smaller**

Uses of Concave Mirrors:
Used in Dentistry, Shaving mirrors, headlights, Astronomical telescopes, etc.

Uses of Convex Mirrors:
Side-view & Rear-view mirrors, Security Mirror (in grocery stores etc.), Traffic Mirrors, ATM convex mirror, etc.

Ray Model of Light



Key Terms (Curved Mirrors)

Center of Curvature (*C*): center of the sphere from which the mirror section is taken.
Focus or **Focal Point** (*F*): point where parallel rays converge (**concave**) or appear to diverge from (**convex**).
Principal Axis: the line passing through *C* and *F*.
Vertex E (*V*/*E*): the center of the mirror.
Focal Length (*f*): distance from *F* to the *vertex E*.

Real vs Virtual Image

Real Image	Virtual image
1. Light rays actually meet to form a real image.	1. Light do not actually meet to form a virtual image.
2. The image is generally inverted.	2. The image is generally erect.
3. Image can be obtained on the screen.	3. Image cannot be obtained on the screen.
4. This image is in front of mirror and behind the lens.	4. This image is behind the mirror and in front of the lens.
5. We can reach to it.	5. We can't reach to it.
6. E.g. :- Cinema screen	6. E.g. :- Our image in plane mirror.

IMAGE FORMATION IN A CONCAVE MIRROR

	IMAGE			
Location of Object	**L**ocation	**O**rientation (upright or inverted)	**S**ize (same, smaller or larger)	**T**ype (real or virtual)
CONCAVE A. Farther than the Center of Curvature	Bet. F and C	inverted	smaller	real
B. At the Center of Curvature	At C	inverted	same size	real
C. Between the Center of Curvature and the Focal point	Beyond C	inverted	larger	real
D. At the Focal point	No Image			
E. Between the Focal point and the Center of the mirror (Vertex)	Behind the mirror	upright	larger	virtual

IMAGE FORMATION IN A CONVEX MIRROR

	IMAGE		
Location of Object	**L**ocation	**O**rientation (upright or inverted)	**S**ize (same, smaller or larger)
CONVEX F. Farther than C in front of the Mirror.	Behind the mirror	upright	smaller
G. Between F and V in front of the mirror	Behind the mirror	upright	smaller

Curved Mirrors / Spherical Mirrors

A *curved mirror* is a reflecting surface in which the reflective surface is a section of sphere. There are two kinds of curved mirrors, the concave and the convex mirrors. A spoon is a kind of a curved mirror with both concave and convex mirror.