Name:_____

Date:_____

_____	_____	_____	_____
22K	**11T**	**2A**	**3C**

Unit Test

Strand: The Wave Nature of Light

Expectations:
E1. analyse technologies that use the wave nature of light, and assess their impact on society and the environment;
E2. investigate, in qualitative and quantitative terms, the properties of waves and light, and solve related problems;
E3. demonstrate an understanding of the properties of waves and light in relation to diffraction, refraction, interference, and polarization.

_____
10K

PART 1 – FILL IN THE BLANKS – 10 MARKS

Directions: Fill in the blanks.

1. A wave with a repeated pattern over time or distance is called

   _____.

2. The index of refraction is the ratio of the speed of light in

   _____ to the speed of light in _____.

3. The nodal line is a line or curve along which _____

   interference results in _____ displacement.

4. A diffraction grating consists of a _____ number of closely

   spaced _____ slits that produces interference patterns.

5. Three ways that polarized light can be produced from unpolarized light are:

   _____, _____, and

   _____.

PART 2 - MATCHING – 5 MARKS

Directions: Beside each definition, write the letter of the term from the right hand column. Use each term only once.

_____	1. The bending of light as it travels at an angle from one medium to another.	A. Dispersion
_____	2. The separation of a wave into its component parts according to a given characteristic.	B. Iridescence
_____	3. The bending and spreading of a wave when it passes through an opening.	C. Reflection
_____	4. The phenomenon that occurs when two waves in the same medium intersect.	D. Incoherence
_____	5. A change in direction of a light ray after meeting an obstacle.	E. Interference
		F. Refraction
		G. Diffraction
		H. Interference

5K

PART 3 – TRUE AND FALSE – 5 MARKS

Directions: For each question below, circle **True** or **False**.

5K

True False 1. Newton's Particle Theory of Light states that light particles travel in straight lines with a maximum velocity and therefore have kinetic energy.

True False 2. At Brewster's angle, the refracted ray and reflected ray are parallel to each other.

True False 3. Specular reflection is the reflection of light from a surface where all the reflected rays are directed in many different directions.

True False 4. A light beam diffracting around a small solid disc will create a bright spot in the centre of the disc's shadow.

True False 5. Electromagnetic waves consist of magnetic and electric fields that are parallel to each other and to the direction of propagation, and oscillate in phase.

PART 4 – MULTIPLE CHOICE – 5 MARKS

Directions: Circle the most correct answer.

2K

1. The colours in anti-reflective coatings on eyeglasses, solar cells, and the colours seen as sunlight shines on a soap bubble, can be explained by
   A. Light interfering as it reflects within a thin film
   B. Light diffracting within a thin film
   C. Light dispersing across a thick film
   D. Light polarizing inside a thin film

2. To increase the distance of the first dark fringe from the central maximum in a single-slit diffraction pattern, you should
   A. Use more intense light
   B. Use light of a longer wavelength
   C. Use light of a higher frequency
   D. Replace the slit with a wider opening

3T

3. All light waves have a speed of $3.0 * 10^8$ m/s. What is the wavelength of light that has a frequency of $5.0 * 10^{14}$ Hz?
   A. $6.0 * 10^{-5}$
   B. $6.0 * 10^{-6}$
   C. $6.0 * 10^{-7}$
   D. $1.5 * 10^{6}$

4. Light travels from air into a transparent material that has an index of refraction of 1.3. The angle of refraction is $45°$. What is the angle of incidence?
   A. $23°$
   B. $45°$
   C. $50°$
   D. $67°$

5. A double-slit experiment uses two slits 0.35 mm apart to produce an interference pattern on a screen 1.5 m from the slits. The distance between adjacent bright spots in 2.4 mm. What is the wavelength of the incident light?
   A. 0.56 µm
   B. 0.56 mm
   C. 0.84 µm
   D. 0.84 mm

PART 5 – SHORT ANSWER – 13 MARKS

Directions: Show your work.

1. Determine the critical angle for light inside a diamond at the diamond-air boundary. The diamond has an index of refraction of 2.42.

3T

1C

2. Most computer LCD projectors emit polarized light of red, green, and blue. You project the image of a white screen from the LDC project. When you hold a polarizing filter in front of the projector lens, the "shadow" case by the filter is bright green.

   A. Explain why the shadow is green.

1T

   B. Predict what would happen if you rotated the polarizing filter by 90°.

2A

1C

PART 5 – SHORT ANSWER – 13 MARKS - CONTINUED

Directions: Show your work.

3. Explain the key differences between Newton's particle theory of light and Huygen's principle. Provide examples to illustrate your point.

4T

1C