

TSOKOS / GIANCOLI READING ACTIVITY

Section 9-3

1. Essential Idea: Interference patterns from multiple slits and thin films produce accurately repeatable patterns.
2. Nature Of Science:
 - a. Curiosity: Observed patterns of iridescence in animals, such as the shimmer of peacock feathers, led scientists to develop the theory of thin film interference.
 - b. Serendipity: The first laboratory production of thin films was accidental.
3. Theory Of Knowledge:
 - a. Most two-slit interference descriptions can be made without reference to the one-slit modulation effect.
 - b. To what level can scientists ignore parts of a model for simplicity and clarity?
4. Understandings:
 - a. Young's double-slit experiment
 - b. Modulation of two-slit interference pattern by one-slit diffraction effect
 - c. Multiple slit and diffraction grating interference patterns
 - d. Thin film interference
5. Applications And Skills:
 - a. Qualitatively describing two-slit interference patterns, including modulation by one-slit diffraction effect
 - b. Investigating Young's double-slit experimentally
 - c. Sketching and interpreting intensity graphs of double-slit interference patterns
 - d. Solving problems involving the diffraction grating equation
 - e. Describing conditions necessary for constructive and destructive interference from thin films, including phase change at interface and effect of refractive index
 - f. Solving problems involving interference from thin films
6. Guidance:
 - a. Students should be introduced to interference patterns from a variety of coherent sources such as (but not limited to) electromagnetic waves, sound and simulated demonstrations
 - b. Diffraction grating patterns are restricted to those formed at normal incidence
 - c. The treatment of thin film interference is confined to parallel-sided films at normal incidence

- d. The constructive interference and destructive interference formulae listed below and in the data booklet apply to specific cases of phase changes at interfaces and are not generally true
7. Data Booklet Reference:
- $n\lambda = d \sin \theta$
 - Constructive interference: $2dn = \left(m + \frac{1}{2}\right)\lambda$
 - Destructive interference: $2dn = m\lambda$
8. Utilization:
- Compact discs are a commercial example of the use of diffraction gratings
 - Thin films are used to produce anti-reflection coatings
9. Aims:
- Aim 4: two scientific concepts (diffraction and interference) come together in this sub-topic, allowing students to analyse and synthesize a wider range of scientific information
 - Aim 6: experiments could include (but are not limited to): observing the use of diffraction gratings in spectroscopes; analysis of thin soap films; sound wave and microwave interference pattern analysis
 - Aim 9: the ray approach to the description of thin film interference is only an approximation. Students should recognize the limitations of such a visualization
10. Read section 9-3, pg. 365-374, in your textbook.
11. Use the Cornell Notes system to take notes on the lesson material. You have the following options:
- You can print multiple copies of one of the forms on the following pages of this document and handwrite your notes.
 - You can use the MS Word form supplied below and type your notes.
 - You can then print your work and submit a hardcopy, or
 - You can upload your work to Focus. If you choose this option, you must use a filename in the format, "LastnameFirstinitialPerXASgnmtName".
 - You can take notes on notebook paper using the Cornell Notes format and submit the hardcopy.
12. When using this form, remember the Five R's of Notetaking:
- Record** – the most important or emphasized information
 - Reduce** – and synthesize information wherever possible, making it as concise as you can
 - Recite** – read your notes out loud
 - Reflect** – and consider how this information is connected to your personal experiences and what you already know
 - Review** – look over your notes more than once
13. As a minimum, you must include notes on the following topics:
- Young's Double-Slit Experiment
 - Difference between constructive and destructive interference with regard to diffracted path differences

- c. Impact of phase difference on path difference for constructive and destructive interference
 - d. Coherent sources (not teachers)
 - e. Intensity in two-slit interference patterns
 - f. Effect of slit-width on intensity
 - g. Multiple-slit diffraction
 - h. Diffraction grating (not how whining students can be grating on your nerves)
 - i. Thin film interference
14. Answers may be typed or neatly printed. You do not need to include this page of instructions with your assignment.
15. **Note: The following computer skills should be practiced:**
- a. *Use Microsoft Equation to type any equations.*
 - b. *Drawings may be freehand, but try to make use of the ‘Shapes’, ‘Insert Picture’ or ‘Insert Clipart’ functions of MS Word.*
 - c. *A reading assignment may contain drawings that would be useful in your notes. If you have scanning capability, you should practice scanning pictures and inserting them into documents. As you prepare for college, you should consider investing in a desktop printer-scanner-copier.*
 - d. *Just remember that for formal reports you have to cite any images that you insert into your document. You don’t have to cite scanned images for this exercise unless you use a source other than the textbook.*

CORNELL NOTES and the 5 R's

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Name:

Date:

Topic:

Questions/Key Points	Notes
SUMMARY:	

Name _____

Date _____

CORNELL NOTES

Topic _____

Questions/key points

Notes

Summary

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