

The Open University of Sri Lanka  
 B.Sc. Degree Programme - Level 05  
 PHU 3144 – Practical Physics  
 Final Examination – 2010/2011  
 Duration: Two and Half Hours (2 ½ Hrs.)



Date: 17<sup>th</sup> June 2011

Time: 1.30 pm -4.00 pm

Answer **Four** Questions Only.

1. The wavelength of a monochromatic light could be determined by the method of Newton rings.

- List the apparatus and accessories required to perform this experiment.
- Write down the experimental procedure, giving all the steps and with the help of suitable diagrams.
- In a similar experiment, a student has obtained the following data set.

Order of fringes	Microscope Readings ( $\pm 0.001$ ) $10^{-2}$ m	
	LHS	RHS
5	20.854	20.602
10	20.898	20.548
15	20.930	20.508
20	20.977	20.473
25	20.997	20.448
30	21.009	20.408

Radius of curvature of the given convex lens is = 0.5 m

Using the above data calculate the wavelength of sodium light.

- What is the uncertainty in your result?

2. You are provided with a single slit and a sodium lamp, and requested to determine the wavelength of sodium light.

- Discuss briefly the optical phenomenon that happens at the slit and the physical theory that describe the above phenomenon, providing suitable diagrams.
- List the additional apparatus and accessories required to carry out this experiment.

- (c) Describe the experimental procedure and list the observations you would make during the process.
- (d) Show how you will determine the wavelength of sodium light from the above observations.
- (e) Discuss the precautions you would take and the methods you would implement to minimize any errors that might occur during the process.
3. You are provided with a spectrometer, which is set with all preliminary adjustments, and you are asked to determine the wavelengths of the visible spectral lines in the hydrogen spectrum using a diffraction grating.
- (a) Describe a method by which a diffraction grating mounted on the levelled prism table could be set normal to the incoming parallel rays.
- (b) Derive the equation you would use in this experiment to determine the wavelengths of the spectral lines.
- (c) A student recorded following data in a similar experiment.

Spectral Lines	First Order Diffraction Angle ( $\pm 30''$ )
Blue – green	$14^{\circ} 56'$
Red	$22^{\circ} 09'$

$$d\text{-spacing} = (1/600) \text{ mm}$$

Using the given data calculate the wavelengths of both spectral lines.

- (d) Estimate the error in your result.
4. Fringes produced by a wedge shaped film can be used to find the radius of a human hair,
- (a) Explain, with the help of clear diagrams, the formation of interference fringes, when a wedge shaped air film is illuminated with a monochromatic light source.
- (b) Describe the theory and the experimental procedure involved in this experiment.

- (c) During a similar laboratory experiment, a student has recorded the following observations. Using these data, determine the radius of human hair.

Effective length of the glass plate ( $L$ ) =  $(7.50 \pm 0.01) 10^{-2}$  m  
 Wavelength of sodium light ( $\lambda$ ) =  $5893 \times 10^{-10}$  m  
 Refractive index of air = 1.0008

Fringe Order	Readings ( $1 \pm 0.001$ ) $10^{-2}$ m
n + 00	12.345
n + 05	12.424
n + 10	12.540
n + 15	12.654
n + 20	12.769
n + 25	12.892
n + 30	12.999
n + 35	13.119
n + 40	13.236

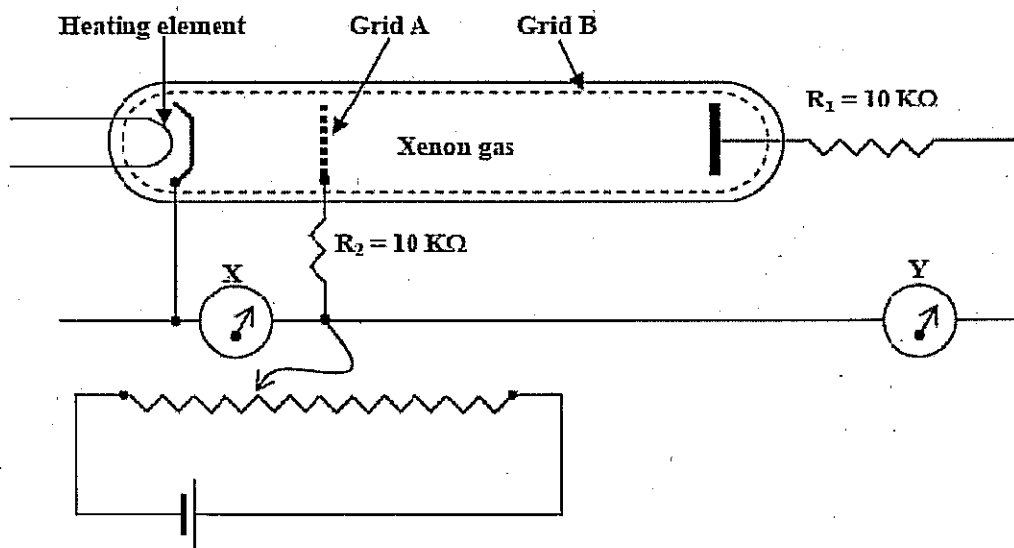
- (d) Estimate the error involved in the above result.

5. (a) Distinguish between the excitation potential and the ionisation potential with respect to atoms.

- (b) The energy  $E_n$  of an electron in the  $n^{\text{th}}$  electronic orbit of a hydrogen atom is given

$$\text{by, } E_n = \frac{-2.1676 \times 10^{-18}}{n^2} \text{ J}$$

Through what voltage does an electron at rest be accelerated to provide the first excitation energy of the hydrogen atom? (Charge of the electron =  $1.602 \times 10^{-19}$  C)



The above diagram shows the experimental arrangement to determine the first ionisation energy of Xenon atoms by bombarding them with low velocity electrons.

- (i) How are electrons produced in this arrangement?
  - (ii) What are the roles of grid A and grid B?
  - (iii) What are the uses of the meters X and Y?
  - (iv) Explain how you would determine the first ionisation potential of Xenon atoms using this experimental arrangement.
6. (a) Explain why it is necessary, to set the telescope and collimator of the spectrometer for parallel rays, and to level the prism table of the spectrometer before using it for any measurement.
- (b) Describe with the help of suitable diagrams, the Schuster method to set the telescope and collimator of a spectrometer for parallel rays. Specify a situation where this method is very useful.
- (c) Explain what is meant by the resolving power of a Prism and its physical significance?
- (d) Describe briefly the functions of following apparatus.
- (i) Diffraction Grating
  - (ii) Double Silt
  - (iii) Biprism
  - (iv) Polarizer
  - (v) Atomiser