

## Practice Problems

16.1 Illumination  
pages 431–438

page 436

1. A lamp is moved from 30 cm to 90 cm above the pages of a book. Compare the illumination on the book before and after the lamp is moved.

$$\frac{E_{\text{after}}}{E_{\text{before}}} = \frac{\left(\frac{P}{4\pi d_{\text{after}}^2}\right)}{\left(\frac{P}{4\pi d_{\text{before}}^2}\right)} = \frac{d_{\text{before}}^2}{d_{\text{after}}^2}$$

$$= \frac{(30 \text{ cm})^2}{(90 \text{ cm})^2} = \frac{1}{9}; \text{ therefore, after}$$

the lamp is moved the illumination is one-ninth of the original illumination.

2. What is the illumination on a surface that is 3.0 m below a 150-W incandescent lamp that emits a luminous flux of 2275 lm?

$$E = \frac{P}{4\pi d^2} = \frac{2275 \text{ lm}}{4\pi(3.0 \text{ m})^2} = 2.0 \times 10^1 \text{ lx}$$

3. Draw a graph of the illuminance produced by a 150-W incandescent lamp between 0.50 m and 5.0 m.

**Illuminance of a 150-W bulb**

$$P = 2275, d = 0.50, 0.75, \dots, 5.0$$

$$E(d) = \frac{P}{4\pi d^2}$$



4. A 64-cd point source of light is 3.0 m above the surface of a desk. What is the illumination on the desk's surface in lux?

$$P = 4\pi(64 \text{ cd}) = 256\pi \text{ lm}$$

$$\text{so } E = \frac{P}{4\pi d^2} = \frac{256\pi \text{ lm}}{4\pi(3.0 \text{ m})^2} = 7.1 \text{ lx}$$

5. A public school law requires a minimum illuminance of 160 lx at the surface of each student's desk. An architect's specifications call for classroom lights to be located 2.0 m above the desks. What is the minimum luminous flux that the lights must produce?

$$E = \frac{P}{4\pi d^2}$$

$$P = 4\pi E d^2$$

$$= 4\pi(160 \text{ lm/m}^2)(2.0 \text{ m})^2$$

$$= 8.0 \times 10^3 \text{ lm}$$

6. A screen is placed between two lamps so that they illuminate the screen equally, as shown in **Figure 16-7**. The first lamp emits a luminous flux of 1445 lm and is 2.5 m from the screen. What is the distance of the second lamp from the screen if the luminous flux is 2375 lm?



Figure 16-7 (Not to scale)

$$E_1 = E_2$$

$$\text{So } \frac{P_1}{d_1^2} = \frac{P_2}{d_2^2}$$

$$\text{or } d_2 = d_1 \sqrt{\frac{P_2}{P_1}}$$

$$= (2.5 \text{ m}) \sqrt{\frac{2375}{1445}}$$

$$= 3.2 \text{ m}$$

# Physics Principles Problems Chapter 12 Study Thermal

**Kumar, K., Davim, J. Paulo**



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**Complex Engineering Systems - Modeling and Optimization** Satyvir Singh, Mukesh Kumar Awasthi, 2026-02-02  
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**Lesson Plan Bklt Physics** Zitzewitz, 2001-09

**Understanding Physics** Michael Mansfield, Colm O'Sullivan, 2011-01-18  
Understanding Physics Second edition is a comprehensive yet compact introductory physics textbook aimed at physics undergraduates and also at engineers and other scientists taking a general physics course Written with today's students in mind this text covers the core material required by an introductory course in a clear and refreshing way A second colour is used throughout to enhance learning and understanding Each topic is introduced from first principles so that the text is suitable for students without a prior background in physics At the same time the book is designed to enable students to proceed easily to subsequent courses in physics and may be used to support such courses Mathematical methods in particular calculus and vector analysis are introduced within the text as the need arises and are presented in the context of the physical problems which they are used to analyse Particular aims of the book are to demonstrate to students that the easiest most concise and least ambiguous way to express and describe phenomena in physics is by using the language of mathematics and that at this level the total amount of mathematics required is neither large nor particularly demanding Modern physics topics relativity and quantum mechanics are introduced at an earlier stage than is usually found in introductory textbooks and are integrated with the more classical material from which they have evolved This book encourages students to develop an intuition for relativistic and quantum concepts at as early a stage as is practicable The text takes a reflective approach towards the scientific method at all stages and in keeping with the title of the text emphasis is placed on understanding of and insight into the material presented

**Applied Mechanics Reviews**, 1965

**The Science Teacher**, 1987

*Design and Optimization of Mechanical Engineering Products* Kumar, K., Davim, J. Paulo, 2018-02-02  
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