InkPhysics

QUESTION WORKBOOK

Lenses and images

Waves · Year 12

21 questions · 63 marks

PRINT EDITION

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SECTION A · Warm-up

A1 State what is meant by the principal focus and the focal length of a converging lens. [2]

A2 Calculate the power of a converging lens of focal length 40 cm, giving the unit. [2]

A3 State the difference between a real image and a virtual image. [2]

A4 An object is placed in front of a diverging lens. State the nature of the image formed. [2]

A5 A converging lens is used to photograph a distant building. State where the image forms, and give its nature. [2]

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A6 A student writes the magnification of an image as m = 0.60 m. State the error the student has made. [1]

SECTION B · Standard

B1 An object is placed 0.45 m from a converging lens of focal length 0.15 m. Calculate the image distance and the magnification. [3]

B2 Describe the paths of the three standard construction rays used to locate the image formed by a thin converging lens. [3]

B3 An object is placed 0.10 m from a converging lens of focal length 0.25 m. Calculate the image position, state the nature of the image, and give its magnification. [4]

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B4 A student covers the top half of a lens with card and predicts the top half of the image will vanish. State and explain what actually happens. [2]

B5 A diverging lens has a power of −4.0 D. Calculate its focal length. [2]

B6 An object is placed 60 cm from a converging lens of power +2.5 D. Calculate the image distance and the magnification. [3]

B7 A converging lens of focal length 0.15 m forms a real image three times the height of the object. Calculate the object distance and the image distance. [4]

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B8 An object 2.0 cm tall stands 0.80 m from a converging lens of focal length 0.25 m. Calculate the height of the image and state its orientation. [3]

SECTION C · Stretch

C1 A lens forms a real image on a screen 0.60 m away when the object is 0.30 m from the lens. Calculate the focal length of the lens. [3]

C2 A +4.0 D converging lens is placed in contact with a −1.5 D diverging lens. Calculate the power and focal length of the combination. [3]

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C3 A projector lens of focal length 5.0 cm throws a sharp image on a screen 3.0 m away. Calculate the object distance, and the magnification of the image on the screen. [4]

C4 Explain, in terms of the images they form, why a magnifying glass must hold the object inside the focal length, and what happens to the image as the object slides out towards the focal point. [3]

C5 A camera has a converging lens of focal length 50 mm which moves towards or away from the sensor to focus. Calculate how far, and in which direction, the lens must move from its position when focused on a very distant object so that an object 1.2 m away is in focus. [4]

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C6 A student must project the image of a slide onto a screen fixed 2.4 m from the lens, with the image at least 20 times the height of the slide. Two converging lenses are available:
Lens L_1: focal length 0.10 m.
Lens L_2: focal length 0.25 m.
Deduce which lens the student should use, and state the distance from the slide to the lens. [5]

C7 Describe an experiment to determine the focal length of a converging lens, using an illuminated object, the lens, a screen and a metre rule. Include the measurements taken, how the focal length is found from them, and one way to check or improve the result. [6]

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