Unit 13 · Light

WORKSHEET

Full marks 49

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 49

1 Key words [4]

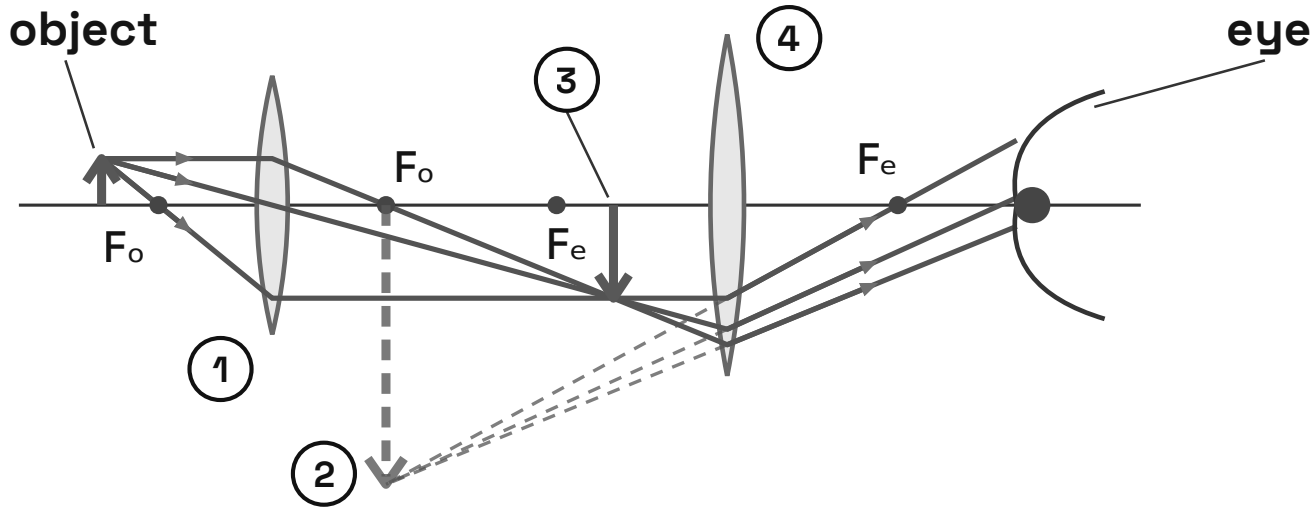
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

concave	convex	diopter	magnification	plano-concave	plano-convex	power	real	virtual	watt

A lens thicker in the middle than at its edges is a _____ lens, and it brings parallel rays together. A lens thinner in the middle is a _____ lens. A lens with one flat face and one bulging face is called _____. The reciprocal of the focal length in meters is the _____ of a lens, and its SI unit is the _____. The height of the image divided by the height of the object is the _____. A _____ image can be caught on a screen, and a _____ image can only be seen by looking into the lens.

2 Label the diagram [2]

The ray diagram is of a compound microscope. Write the word that belongs in place of each number. Each carries 0.5 mark.



1. _____ 2. _____

3. _____ 4. _____

3 True or false [3]

Write ✓ for a true statement and ✗ for a false one. Each carries 0.5 mark.

i. A lens of −8 D bends light less strongly than a lens of +5 D. ☐

ii. A concave lens always gives a virtual, upright, diminished image of a real object. ☐

iii. A negative value of v means the student has made a mistake. ☐

iv. To make an astronomical telescope magnify more, use an eyepiece of shorter focal length. ☐

v. In a compound microscope, the eyepiece has a shorter focal length than the objective. ☐

vi. A convex lens used as a magnifying glass has the object inside its focus. ☐

4 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The focal length of a lens of power −4 D is: [1]

a. +25 cm **b.** −25 cm
c. −4 cm **d.** −0.4 m

ii. An object placed 20 cm from a convex lens of focal length 10 cm forms an image: [1]

a. 10 cm from the lens, diminished **b.** 20 cm from the lens, the same size
c. 40 cm from the lens, magnified **d.** at infinity

iii. A convex lens gives a virtual image when the object is: [1]

a. beyond 2F **b.** at 2F
c. between F and 2F **d.** between F and the lens

iv. In a compound microscope, the first image formed by the objective is: [1]

a. virtual, upright and magnified **b.** real, inverted and magnified
c. real, inverted and diminished **d.** virtual, inverted and diminished

v. Two lenses of power +3 D and −1 D are placed in contact. The focal length of the combination is: [1]

a. 25 cm **b.** 50 cm
c. 100 cm **d.** −50 cm

5 Very short answers [3]

Write very short answers to the following questions.

a. What is the least distance of distinct vision for a young adult? [1]

b. A hand lens of focal length 5 cm has what magnifying power when the image is formed at 25 cm? [1]

c. What is the total magnification of a microscope with a 10× eyepiece and a 40× objective? [1]

6 Short answers [8]

Write short answers to the following questions.

a. Give a reason: the power of a concave lens is negative. [2]

b. Give a reason: the objective of an astronomical telescope is made large. [2]

c. Give a reason: the object in a compound microscope is placed just beyond the focus of the objective, and not inside it. [2]

d. Write any two differences between the magnification and the power of a lens. [2]

7 Long answers [8]

Write long answers to the following questions.

a. State the lens formula and the sign convention used with it. Derive it for a convex lens forming a real image. [4]

b. Describe the basic structure and function of an astronomical telescope, with a labeled ray diagram for normal adjustment. **[4]**

8 Numerical problems [13]

Solve the following problems. Show your working. Use the unit's signs: real distances positive, virtual negative, f positive for a convex lens and negative for a concave one.

a. An object 3 cm tall is placed 8 cm from a convex lens of focal length 12 cm. Find the position, nature and height of the image. **[3]**

Answer:

b. An object is placed 60 cm from a concave lens of focal length 20 cm. Find the position, nature and magnification of the image. **[3]**

Answer:

c. In a compound microscope, the objective has a focal length of 2 cm and an object is placed 2.5 cm from it. The eyepiece has a focal length of 5 cm and the final image is formed at the least distance of distinct vision (25 cm). Find the magnifying power and the distance between the two lenses. **[4]**

Answer:

d. Pemba builds a telescope 55 cm long in normal adjustment that magnifies 10 times. Find the focal lengths and powers of the two lenses. **[3]**

Answer: _____

9 Think **[3]**

You have three convex lenses, of focal lengths 2 cm, 5 cm and 50 cm. Which two would you use for a microscope, and which two for a telescope? Explain.

10 Activity: Find the focal length of a convex lens (not marked)

Focus a distant window onto a card to get a rough f. Then put a lit candle more than f from the lens, move the card until the flame's image is sharp, and fill in the table for four positions of the candle.

u (cm)	v (cm)	$\frac{1}{u} + \frac{1}{v}$	f (cm)	Bigger or smaller?