

*This exam is formed of four obligatory exercises in two pages.
The use of non-programmable calculator is allowed.*

Exercise 1: True of false questions (2 points)

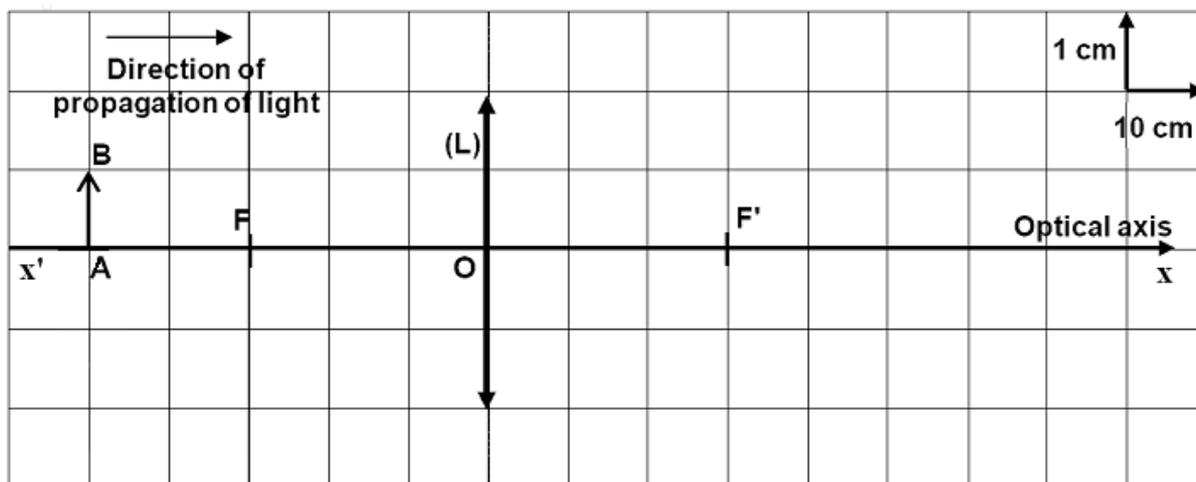
Answer by "True" or "False", and correct the false statement.

- 1- The image obtained by a diverging lens is always real.
- 2- Two lamps L_1 and L_2 are connected in parallel across a DC generator. The voltage across L_1 is equal to the voltage across L_2 .
- 3- The (voltmeter) is a used to measure the electric current..
- 4- The Oscilloscope is connected in series across the terminal of the dry cell to measure its voltage.

Exercise 2: Image given by a converging lens(6 ½ pts)

The object of this exercise is to determine the characteristics of the image $A'B'$ of an object AB , given by a converging lens (L).

The diagram below shows the converging lens (L), its optical axis $x'Ox$, its two foci F and F' and the object AB .



1) Construction of the image $A'B'$

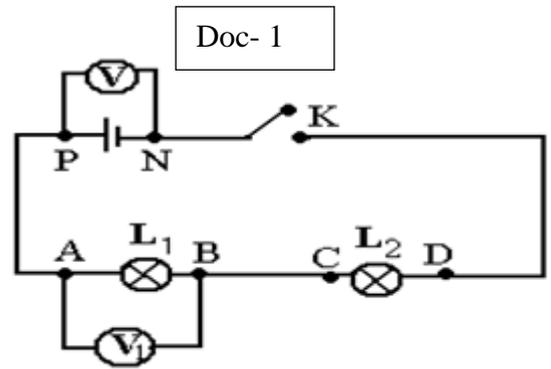
- 1-1) Reproduce, on the graph paper the above diagram with the same given scale.
- 1-2) Construct, by tracing two particular luminous rays, the image B' of B .
- 1-3) Construct the image $A'B'$.

2) Characteristics of $A'B'$

- 2-1) Give, with justification, the nature of $A'B'$.
- 2-2) Indicate the direction of the image $A'B'$ with respect to AB ?
- 2-3) Determine the size of the image $A'B'$.
- 2-4) At what position from (L) , should a screen be placed to obtain the image $A'B'$?

Exercise 3: Voltage (6 pts)

1) Consider the following circuit in the adjacent (Doc -1).



1-1) What do the two voltmeters V and V1 measure?

1-2) In case 1: The switch K is opened. The voltmeter V indicates 8.2V. Determine the voltage across the terminals of L1, L2 and K.

2) In case2: The switch K is closed and the voltmeter V1 indicates 3v.

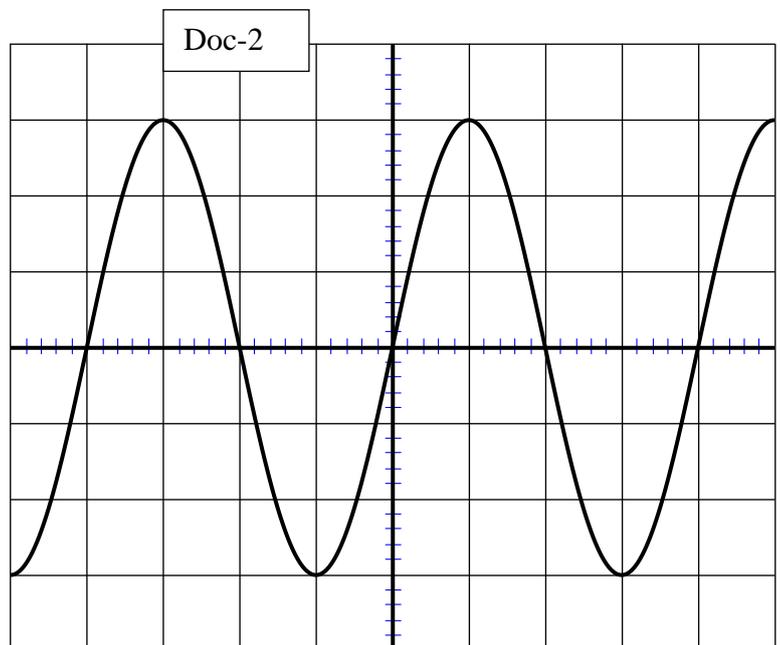
2-1) Determine the voltage across the terminals of L2 and K.

2-2) Calculate the current in L2 if the resistor of L2 is 10Ω .

2-3) If the points P and N across the drycell are connected to an oscilloscope with P connected to its ground. What is the indicated voltage on the oscilloscope? Justify

Exercise 4: Alternating Voltage(5 1/2 pts)

We display on the screen of an oscilloscope, the voltage represented by the adjacent oscillogram (Doc -2). The settings are: $S_v = 5\text{v/div}$ and $S_h = 2\text{ ms/div}$.



- 1) Identify the type of the alternating voltage.
- 2) The represented voltage is periodic, calculate its period and frequency.
- 3) Calculate the maximum voltage U_m .
- 4) Calculate the Effective voltage U_e .
- 5) Determine S_h to observe only one cycle on the screen of the oscilloscope.

-Solution

Exercise 1:		2 pts.
1-	False, the image obtained by a diverging lens is virtual.	½
2-	True.	½
3-	False, the ammeter	½
3-	False The oscilloscope is connected in parallel	½

Exercise 2:		6 ½ pts.
1-1	Reproduction of the diagram	1
1-2	Constructing two particular rays (Drawing + explanation)	1 ½
1-3	Construction of A'B' (Drawing + explanation)	1
2-1	The image is real because the emerging rays intersect behind the lens	½
2-2	The image is inverted with respect to the object	½
2-3	The size of the image = 1.5 div. × 1 cm/div = 1.5 cm	1
2-4	The screen should be placed at 7.5 div. × 10 cm/div = 75 cm	1

Exercise 3:		6 pts.
1-1	V measures the voltage across the generator, U_{PN} V_1 measures the voltage U_{AB} across L1.	¾ ¾
1-2	$V(L1) = 0v$ $V(L2) = 0v$ $V(k) = 8.2v$	½ ½ 1
2-1	$V(k) = 0V$ $V(L2) = 8.2 - 3 = 5.2V$	½ 1
2-2	$I = 5.2/10 = 0.52A$	
2-3	the luminous line is displaced below the axis, and the oscilloscope measures U_{NP} .	1

Exercise 4:		5 ½ pts.
1)	Sinusoidal alternating current	½
2)	$T = x S_h = 4 \times 2 = 8ms = 8 \times 10^{-3} s$ $f = 1/T = 125Hz$	1 1
3)	$V = 3 \times 5 = 15V$	1
4)	$U_e = 15/1.41 = 10.63 V$	1
5)	$S_h = 8ms/8 = 1ms$	1