

# How to Calculate Illumination Level

## Worksheet

Average illuminance is calculated as  $E = (F N UF MF) / A$ , where lamp lumens and count are scaled by utilization and maintenance factors and divided by the floor area, giving a result in lux.

$$E = \frac{F N UF MF}{A}$$

## Questions

1. What is the formula for average illuminance (lumen method)?

- A)  $E = F/A$
- B)  $E = (FNUFMF)/A$
- C)  $E = FA$
- D)  $E = N/A$

2. What is the unit of illuminance?

- A) Candela
- B) Lumen
- C) Lux
- D) Watt

3. If UF and MF both decrease, what happens to illuminance E (all else equal)?

- A) E increases
- B) E decreases
- C) E stays the same
- D) Cannot be determined

4. A room needs 400 lux over 50 m. If  $F=5000$  lm,  $UF=0.5$ ,  $MF=0.8$  per luminaire, how many luminaires are needed (round up)?

- A) 8
- B) 10
- C) 12
- D) 14

5. A classroom (60 m) uses 12 luminaires, each producing 3000 lm, with  $UF=0.55$  and  $MF=0.8$ . Find the average illuminance.

6. An office (40 m) needs 500 lux. Each luminaire delivers 4000 lm,  $UF=0.6$ ,  $MF=0.85$ . How many luminaires are needed?

7. A warehouse aisle (100 m) has 8 fixtures at 12000 lm each,  $UF=0.45$ ,  $MF=0.75$ . Find the illuminance level.

8. Define: What is illuminance measured in?

9. Define: What is the lumen method formula?

10. Define: What is the utilization factor (UF)?

## Answer Key

1. B)  $E = (FNUFMF)/A$  - The lumen method formula is  $E = (FNUFMF)/A$ , accounting for lamp output, count, utilization and maintenance factors.
2. C) Lux - Illuminance is measured in lux, defined as lumens per square meter.
3. B)  $E$  decreases -  $E$  is directly proportional to  $UF$  and  $MF$ , so decreasing either lowers the calculated illuminance.
4. B)  $10 - N = (EA)/(FUFMF) = (40050)/(50000.50.8) = 20000/2000 = 10$  luminaires.
5.  $E = (FNUFMF)/A$   $E = (3000120.550.8)/60$   $E = 15840/60$   $E = 264$  lux
6. Rearrange:  $N = (EA)/(FUFMF)$   $N = (50040)/(40000.60.85)$   $N = 20000/2040$   $N = 9.8$  round up to 10 luminaires
7.  $E = (FNUFMF)/A$   $E = (1200080.450.75)/100$   $E = 32400/100$   $E = 324$  lux
8. Lux (lx), equal to one lumen per square meter (lm/m<sup>2</sup>).
9.  $E = (F N UF MF) / A$  - average illuminance from total lamp output, utilization and maintenance factors over the area.
10. The fraction of emitted luminous flux that actually reaches the working plane, accounting for room reflectance and fixture design.

### Bounlu

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