

Course outline

How does an NPTEL online course work?

Week 1

- General Introduction, Scope and Contents
- Interaction of Radiation with Matter
- The Einstein Coefficients
- Week 1 Feedback Form
- Quiz : Assignment 1

Week 2

Week 3

Week 4

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Assignment Solutions

Lecture Slides

Download Videos

Assignment 1

The due date for submitting this assignment has passed.

Due on 2021-02-03, 23:59 IST.

As per our records you have not submitted this assignment.

Instructions:

1. Answer all questions; all questions carry equal mark.
2. All symbols have their usual meanings.
3. Only one of the options is correct.
4. Take care of the units in numericals, to match with the units given in the options (of MCQs), and the units in which answers have to be entered (in fill in the blank type of questions).
5. In the fill in the blank type of questions, only the numerical values have to be entered.

NOTE: You can see the correct answers after the last date of submission. Marks obtained in this quiz will be counted towards your final score. You can take the quiz and submit it any number of times, and the latest submitted answers will be taken as your final submission.

 1) Which one of the following is NOT a property of a typical laser? **1 point**

- High directionality
- High linewidth
- High intensity
- High coherence

No, the answer is incorrect.
Score: 0
Accepted Answers:
High linewidth

 2) The gain medium of a laser cannot provide amplification without a suitable pump. **1 point**

The above statement is-

- TRUE
- FALSE

No, the answer is incorrect.
Score: 0
Accepted Answers:
TRUE

 3) What is the separation between the D₁ and D₂ lines of a sodium lamp output? **1 point**

- 3 x 10⁻⁹ m
- 6 x 10⁻⁹ m
- 3 x 10⁻¹⁰ m
- 6 x 10⁻¹⁰ m

No, the answer is incorrect.
Score: 0
Accepted Answers:
6 x 10⁻¹⁰ m

 4) If a laser emits light of wavelength 600 nm with a linewidth ($\Delta\nu$) of 10 GHz, then the linewidth of the laser in terms of wavelength ($\Delta\lambda$) is ____ nm. (Enter the answer up to 3 decimal places)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.01,0.014
1 point

 5) The density of states for photons of wavelength 500 nm in a blackbody radiation is _____ x 10⁵ m⁻³s. (Assume refractive index of medium n_r = 1). (Enter the answer up to two decimal places)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 3.2,3.5
1 point

 6) In a non-degenerate 2-level atomic system in thermal equilibrium at room temperature, a photon is emitted at the wavelength of 800 nm. The energy difference between the two levels is approximately **1 point**

- 1.05 eV
- 1.55 eV
- 2.35 eV
- 3.45 eV

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.55 eV

 7) In the above 2-level atomic system, if N₁ is the number density of atoms in the first level and N₂ that in the second level, then, ln(N₁/N₂) is _____. (Answer must be entered as an integer)

NOTE: The function 'ln' above refers to Natural Logarithm

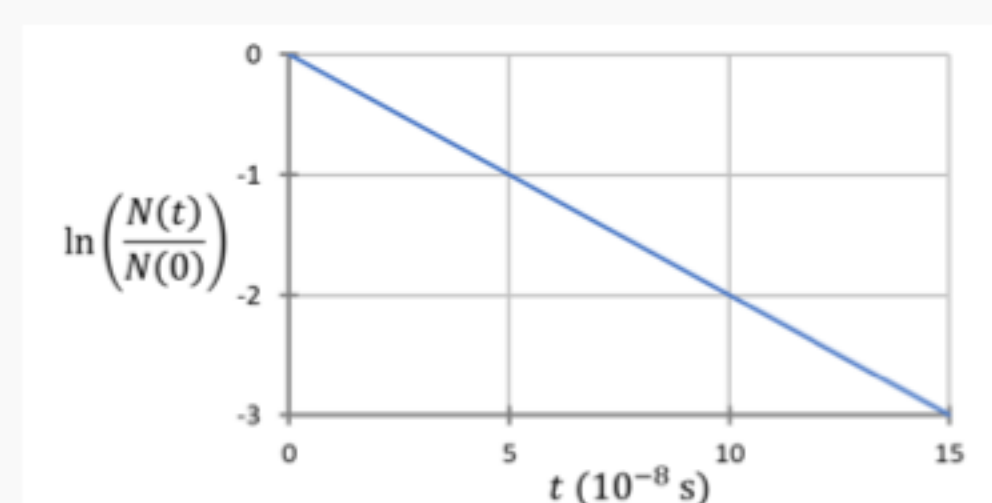
No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 60,64
1 point

 8) Which of the following statements regarding a 2-level atomic system is incorrect? **1 point**

- At thermal equilibrium in room temperature, the number of spontaneous emissions far exceed stimulated emissions.
- Larger is the spontaneous emission lifetime, faster is the decay of excited atoms.
- As temperature increases, the ratio N₂/N₁ also increases.
- The ratio of Einstein coefficients (A/B) is inversely proportional to λ^3 .

No, the answer is incorrect.
Score: 0
Accepted Answers:
Larger is the spontaneous emission lifetime, faster is the decay of excited atoms.

9) Under excitation by impulses (at t = 0) of suitable energy, the instantaneous population of a particular energy level of an atomic system varies with time as shown in the figure below:


 The spontaneous transition rate of the level is _____ x 10⁶ s⁻¹. (Answer must be entered as an integer)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 20
1 point

 10) The difference between the energy levels of a 2-level atomic system is 1.5 eV. Determine the temperature at which the rate of spontaneous emission would be equal to the rate of stimulated emission. **1 point**

- 3.68 K
- 301 K
- 2.51x10⁴k
- 1.67x10⁴k

No, the answer is incorrect.
Score: 0
Accepted Answers:
2.51x10⁴k