Photonics Concepts Learning Unit 11 Quiz (28 pts)

The time required for half of the atoms in that state to make a downward transition without benefit of an outside source is the _____.

a. absorption b. atomic transition
c. atomic lifetime d. wavenumber

_____ energy states that have very long atomic lifetimes.

a. higher b. lower
c. metastable d. quazistable

When an atom makes a downward transition without releasing a photon it is call a _____.

a. spontaneous emission
b. stimulated emission
c. radiationless transition
d. atomic lifetime

When a photon incident upon an atom causes that atom to release another photon with the same energy, frequency, direction and phase it is called _____.

a. spontaneous emission
b. stimulated emission
c. emission spectrum
d. radiationless transition

When a photon is emitted without the benefit of external stimulus and has random direction it is called _____.

a. spontaneous eruption
b. stimulated emission
c. spontaneous emission
d. stimulated evolution

The _____ is the minimum allowed energy of an atom.

a. ground state b. population inversion
c. electron volt d. wavenumber

When an atom moves from one level to another it is a/an _____.

a. spontaneous jump b. population inversion
c. photon emission d. atomic transition

Each of the lasing lines within the spectrum actually consist of a narrow range of wavelengths which is the result of a phenomenon called _____.

a. population inversion
b. doppler broadening
c. divergence
d. monatomic action

The condition where the absorption coefficient of a lasing medium becomes negative, gain is greater than one, and there are more atoms at upper lasing levels than lower lasing levels is known as _____.

a. spectral matching b. population inversion
c. metastable ground d. lasing transition

In a laser cavity, a wave with nodes at each mirror oscillates between mirrors and appears to be standing still is referred to as a _____.

a. standing wave b. mode number
c. emission wave d. q-switch

What is the time interval between similar points on two consecutive laser pulses?

a. Pulse repetition rate
b. Pulse duration
c. Pulse repetition time
d. Pulse power

_____ is the product of power and time, and is represented by the area under the laser pulse.

a. Energy b. Power
c. Pulse width d. Peak power

What is the total energy per pulse of a beam with a pulse duration of 50ns and a maximum power of 1 MW(mega)?

a. 50 mJ b. 50 pJ
c. 5 μJ d. 50 mW

The average power measured at the output of a pulsed CO_2 laser is 139W. The pulse repetition time is 0.4 ms. Find the energy per pulse of this laser system.

a. 55.6 mJ b. 1.79 J
c. 34.75 kJ d. 28.8 μJ

At what point is the beam diameter always measured?

a. 50% b. 10%
c. 86% d. 13.5%

What is the "ratio of the pulse duration to the pulse repetition time?

a. Q b. Average power
c. Pulse repetition rate d. Duty cycle

As a beam propagates it _____ and this is measured in radians.

a. Pulses b. Converges
c. Diverges d. Reverses

A laser beam focused by a 10.25 cm focal length lens, creates an image of the beam waist with a diameter of 0.25mm. What is the beam divergence?

a. 48.1 mrad b. 10.26 mr
c. 410 rad d. 2.4 mra

A laser is best described by which of the following?

a. a point source of light
b. a powerful incandescent light source
c. a light amplifier
d. a modern source of gamma rays

Which of the following is ***not*** a special property of laser light?

a. coherence b. large beam spread
c. monochromaticity d. focusable to small spots

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Which of the following is a special requirement for laser operation?
a. stimulated emission
b. spontaneous emission
c. broadband absorption
d. Doppler-line broadening

Spontaneous emission is characterized by
a. emission of photons all in phase with each other
b. emission of photons all moving in the same direction
c. emission of photons all with precisely the same energy
d. emission of photons in random directions with random phases

Stimulated emission is characterized by:
a. the emission of photons, identical in every way, to the one which caused the emission
b. the emission of photons going off in many directions
c. the emission of photons with many different phases
d. the absorption of photons from lower to higher energy levels

A population inversion is required for ordinary laser operation. A population inversion means that:
a. there are more atoms in a given upper energy level than in a given lower energy level at a given time
b. the population of any two energy levels flip-flops back and forth as the temperature is raised
c. emission is always the opposite of absorption between two given energy levels
d. the highest and lowest energy levels exchange populations at temperatures near absolute zero

Which of the following is ***not*** an important part of a laser?
a. a neutral density filter
b. a gain medium
c. a resonant cavity involving two mirrors
d. an external excitation energy source

Which of the following is important to consider in determining the types of mirror arrangements to use in a laser optical cavity?
a. laser gain volume
b. ease of alignment
c. cost of manufacturing the mirrors
d. all of these

The laser notation TEM00 refers to:
a. a longitudinal mode in a laser
b. the temperature of the laser gain medium at absolute zero
c. the electromagnetic (EM) spectrum in the x-ray region
d. a transverse intensity distribution of the laser beam

A laser beam with a beam divergence of 3.2 mrad is focused by a converging lens of focal length 1.95cm. The diameter of the focused spot is:
a. 6.24cm
b. 6.24mm
c. 62.4μm
d. 6.24m