Unit 7 - Week 5 - Critical optical tool for QC " LASERS "

Assignment - 5

The due date for submitting this assignment has passed. Due on 2019-09-04, 23:59 IST.
As per our records you have not submitted this assignment.

1) The initial photon creation in the lasing action after __(i)__ the gain medium through absorption is due to __(ii)__, while the light amplification part results from ___(iii)___. 1 point

- (i) Dumping (ii) Stimulated emission (ii) Stimulated emission
- (i) Pumping (ii) Spontaneous emission (iii) Stimulated emission
- (i) Cooling (ii) Stimulated emission (iii) Spontaneous emission
- (i) Heating (ii) Stimulated emission (iii) Metastable state

No, the answer is incorrect.
Score: 0
Accepted Answers:
(i) Pumping (ii) Spontaneous emission (iii) Stimulated emission

2) For a linear cavity laser having a repetition rate (i.e., the repeat frequency of appearance of longitudinal modes) of 500 MHz, what is the length of the laser cavity ? 1 point

- 300 cm
- 300 mm
- 3 m
- 0.333 m

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

3) The thermal energy of N molecules at room temperature (300 K) corresponds to an energy gap of 0.01 eV. What is in the order of magnitude of the frequency the corresponding photons? 1 point

- 10^{13} Hz
- 0.1 Hz
- 1 MHz
- 0.001 Hz

No, the answer is incorrect.
Score: 0
Accepted Answers:
10^{13} Hz

4) Consider a transform-limited pulsed laser operating at a central wavelength of 800 nm that outputs a Gaussian pulse with full-width half maximum of 10×10^{-15} s. What is the spectral bandwidth of this laser ? 1 point

- 94 nm
- 10 nm
- 47 nm
- 60 nm

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

5) How can you get a Laser Gain Medium at a temperature of 20762 K to have both stimulated and spontaneous emission rates to be equal ? 1 point

- If the Laser Gain Medium is cooled to 20 K
- If the Laser Gain Medium is 'pumped' resonantly at 1 μm wavelength
- If the Laser Gain Medium is 'dumped' using 1 μm wavelength
- If the Laser Gain Medium is cooled to 10065 K

No, the answer is incorrect.
Score: 0
Accepted Answers:
If the Laser Gain Medium is 'pumped' resonantly at 1 μm wavelength

6) Both the laser divergence and the smallest possible spot-size to which the laser can be focused increases as 1 point

- the laser wavelength increases
- the laser wavelength decreases
- the laser repetition rate changes but has no change in its wavelength
- the laser becomes less intense but has no change in its wavelength

No, the answer is incorrect.
Score: 0
Accepted Answers:
the laser wavelength increases

7) The intensity variation with time of the Kerr Lens mode locked Ti:Sapphire laser pulse train has the form: $I \sim |E|^2 = E_0^2 \frac{\sin^2(N\Delta\omega t/2)}{\sin^2(\Delta\omega t/2)}$, where E_0 is the electric field amplitude of each mode, N is the number of modes, and $\Delta\omega$ is the frequency spacing between the modes. Such a laser would generate 1 point

- an output of continuous intensity, $I \sim N^2 E_0^2$.
- pulses with very low energy long pulses at a repetition rate of $\Delta\omega/2\pi$
- pulses with peak intensity, $I \sim N^2 E_0^2$, and width of $2\pi/N\Delta\omega$ that are separated in time by $2\pi/\Delta\omega$.
- an output of arbitrary laser power that cannot be characterized

No, the answer is incorrect.
Score: 0
Accepted Answers:
pulses with peak intensity, $I \sim N^2 E_0^2$, and width of $2\pi/N\Delta\omega$ that are separated in time by $2\pi/\Delta\omega$.

8) What is population inversion ? 1 point

- When the number of electrons is equal in both the ground and excited energy states
- When the number of electrons in the lower energy state is more than that in the higher energy state
- When the number of electrons in higher energy state is more than ground state
- Measurement of population of electrons in any given state

No, the answer is incorrect.
Score: 0
Accepted Answers:
When the number of electrons in higher energy state is more than ground state

9) It is considered unphysical for population inversion to occur in an ideal two-level system, although it is observed in three or more level system. This is 1 point

- because any two-level system is always in the population inversion condition
- because thermodynamically unphysical sub-zero Kelvin temperature is needed to achieve population inversion in two level systems
- because there is no true two-level system
- untrue as it is possible to achieve population inversion in two level

No, the answer is incorrect.
Score: 0
Accepted Answers:
because thermodynamically unphysical sub-zero Kelvin temperature is needed to achieve population inversion in two level systems

10) Consider optical pumping at 940 nm of a Yb:YAG crystal placed inside a laser cavity. The lasing wavelength of ytterbium (Yb) is 1030 nm. Considering that all the photons emitted by the pump are absorbed by the crystal and is used for the lasing process, we get the maximum power output of 912 mW. What is the pump power to achieve this ? 1 point

- 990 mW
- 940 mW
- 912 mW
- 1 W

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