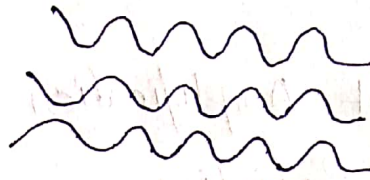
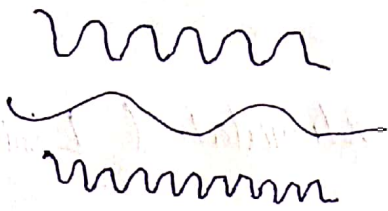


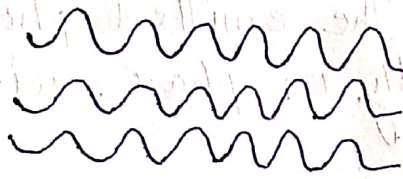
LASER — Light Amplification by Stimulated Emission of Radiation.

Properties or characteristics of Laser! —

- ① Coherence (same phase) : — Laser light is perfectly coherent in nature i.e. the waves are exactly in phase with one another. The emitted photon after getting triggered is exactly in phase with incident photon.
- ② Monochromaticity (i.e. same wavelength or frequency) : — The laser light is perfectly monochromatic. The light emitted by laser is having same wavelength & frequency than any other monochromatic source.
- ③ Unidirectionality (sharp focus) : — Any light source emits light in all direction but laser emits light in one direction. The width of laser beam is very narrow and can travel to long distance without spreading. Hence it is sharply focused.
- ④ High intensity (extreme brightness) : — In laser, the emitted photon and incident photon are in same phase, therefore the laser light is much more intense i.e. brighter than that from any of the other source.



- (a) Ordinary light. (Phase & frequency/wavelength are mismatching).  
 (b) Monochromatic incoherent light (frequency/wavelength is same but phase is mismatching i.e. different).



- (c) Monochromatic coherent light (Laser) (Phase, frequency/wavelength all are ~~not~~ matching i.e. same).

### Absorption or Stimulated Absorption:-

When a photon of energy  $h\nu = E_2 - E_1$  is incident on an atom then the atom gets excited i.e. moves from lower energy level  $E_1$  to higher level  $E_2$  by absorbing the energy of incident photon is called Absorption or Stimulated Absorption.

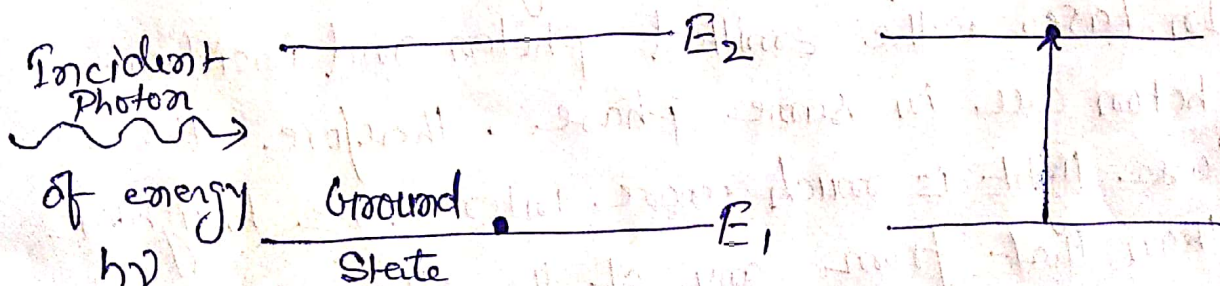
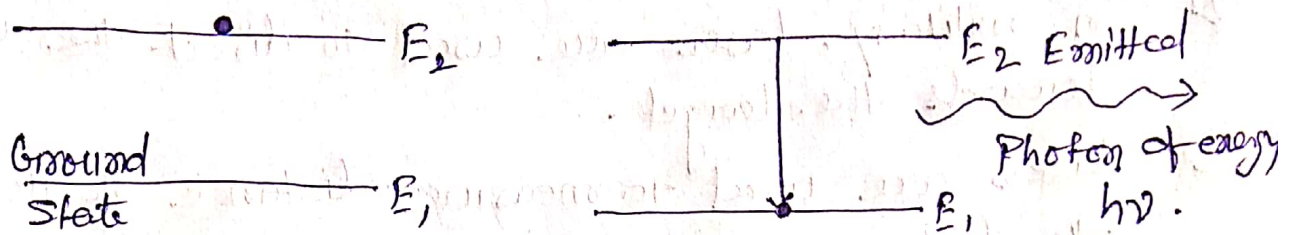


fig: Excitation due to Absorption.

## Spontaneous Emission :- (03)

The atom is in excited state i.e.  $E_2$  and comes to ground state i.e.  $E_1$  state spontaneously (i.e. on its own) and emitting a photon of energy  $h\nu$ . This is known as spontaneous emission.



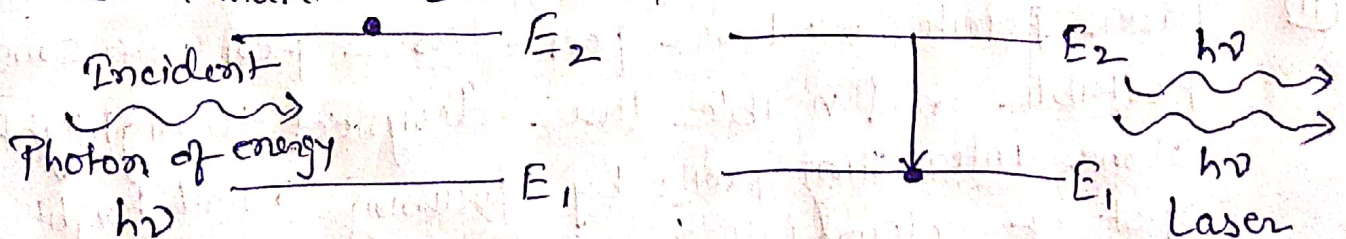
fig>: Spontaneous emission.

## Stimulated Emission :-

When the atom is in excited state, before its transition to the ground state, the atom is triggered due to an action of incident photon.

The interaction between the excited atom and incident ~~for~~ photon make the transition of excited atom from  $E_2$  to  $E_1$ .

And this transition generates another photon which is identical to the incident photon i.e. having same phase i.e. coherent, same wavelength i.e. monochromatic, same direction. This is known as stimulated emission.



fig>: Stimulated emission.

## Application of Laser:-

- ① Lasers are used to read bar code in shopping malls, library etc.
- ② Lasers are used in cutting, drilling and welding etc.
- ③ Lasers are used in surgery for destroying kidney stone, cancer cells.
- ④ In military, lasers are used to direct the weapons towards the target.
- ⑤ Lasers are used to measure distance of the planet e.g. distance of ~~the~~ moon from the earth.
- ⑥ Lasers are used in holography, printers.
- ⑦ Lasers are used by dentists for dental surgery.
- ⑧ Lasers are used for engraving and embossing of printing plates i.e. number plate, ~~name of~~ name of company, monogram of the company.
- ⑨ Lasers are used by doctors in eye surgery, soft tissue laser surgery, cosmetic surgery (e.g. removing tattoos, scars, stretch marks, wrinkles, sunspots etc).
- ⑩ Lasers are used for 3D laser scanners - analyse the real world object - collected data can be used to construct digital 3-dimensional models.
- ⑪ Lasers pointer or laser pen - laser pen is a small portable and visible laser designed to highlight some interesting parts by focussing small bright spot of coloured light on to it.