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reviewer1@nptel.iitm.ac.in ▼

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## Unit 2 - Week 1

### Course outline

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#### Week 1

- Lecture 1: Electromagnetic radiation
- Lecture 2: Interaction of radiation with matter
- Lecture 3: Introduction to chemical applications
- Lecture 4: Features Common to Spectra
- Lecture 5: Radiation densities and Einstein's semi classical model
- Quiz : Assessment 1
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#### Week 2

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## Assessment 2

The due date for submitting this assignment has passed. **Due on 2016-03-18, 23:59 IST.**

### Submitted assignment

1) Light photon with a wavelength of 100 nm falls on a metal which requires  $4.4 \times 10^{-19} J$  for **1 point** ejecting the electron from the light energy. The kinetic energy of the ejected electron is

- $1.56 \times 10^{-18} J$
- $1.56 \times 10^{-19} J$
- $19.9 \times 10^{-19} J$
- $1.99 \times 10^{-19} J$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$1.56 \times 10^{-18} J$

2) A laser radiation has a power of 1 mW ( $10^{-3} J \cdot s^{-1}$ ). If the wavelength of light emitted is **1 point** 6626 Angstroms, the number of photons in the laser radiation per second is

- $10^{14}$
- $10^{15}$
- $3.33 \times 10^{15}$
- $10^{16}$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

$3.33 \times 10^{15}$

3) Radiation density per unit volume per unit time, according to Planck's law depends on the **1 point** frequency  $\nu$  as

- $\frac{8\pi k_B T}{c^3} \nu^2$
- $\frac{8\pi h \nu^3}{c^3 (e^{h\nu/k_B T} - 1)}$

$$\frac{8\pi h\nu^3}{c^3(e^{-h\nu/k_B T}-1)}$$

$$\frac{8\pi k_B T}{c^3 \nu^2}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\frac{8\pi h\nu^3}{c^3(e^{h\nu/k_B T}-1)}$$

4) In Einstein's theory emission of radiation from excited state happens either as spontaneous **1 point** or is due to stimulated by radiation. The rate of change of the concentration of excited molecules due to spontaneous emission is proportional to

- excited state molecular concentration only
- radiation density only
- excited state molecular concentration and radiation density
- the inverse of radiation density

No, the answer is incorrect.

Score: 0

Accepted Answers:

*excited state molecular concentration only*

5) The macroscopic absorption and spontaneous emission coefficients are proportional to **1 point**

- The dipole moment matrix element between states of change
- The absolute square of the dipole moment matrix element between states of change
- Independent of molecular dipole moments
- Inversely proportional to the dipole moment matrix element between states of change

No, the answer is incorrect.

Score: 0

Accepted Answers:

*The absolute square of the dipole moment matrix element between states of change*

6) The unit for gyromagnetic ratio of nuclei is **1 point**

- Hz
- Hz. Tesla
- 
- Hz. Tesla<sup>-1</sup>
- Tesla

No, the answer is incorrect.

Score: 0

Accepted Answers:

*Hz. Tesla<sup>-1</sup>*

7) The gyromagnetic ratios for <sup>13</sup>C and <sup>1</sup>H are in the ratio 1:4. For the same given static magnetic field strength, the energy level splitting for the carbon and hydrogen are in the ratio **1 point**

- 1 : 1
- 1 : 2
- 1 : 3
- 1 : 4

No, the answer is incorrect.

Score: 0

Accepted Answers:

*1 : 4*

8) **1 point**

H<sub>2</sub>(hydrogen molecule) and HD (mono-deuterated hydrogen molecule) have the same bond length. Their moments of inertia are in the ratio

- 1 : 1.333 for H<sub>2</sub> : HD
- 1.333 : 1 for H<sub>2</sub> : HD
- 1 : 2 for H<sub>2</sub> : HD
- 2 : 1 for H<sub>2</sub> : HD

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*1 : 1.333 for H<sub>2</sub> : HD*

9) Both HCl and DCl (Deuterated hydrogen chloride) have nearly the same bond strength and therefore the same force constant. Their vibrational frequencies are in the ratio (HCl : DCl) **1 point**

- 1 : 1 (no change)
- 2 : 1
- 1 : 4 : 1
- 1 : 1 : 4

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*1 : 4 : 1*

10) The ratio of spontaneous emission coefficient (A) and the absorption coefficient (B), denoted by A/B has the dimension **1 point**

- $ML^{-1}T^{-1}$
- $MLT$
- $ML^2T^{-2}$
- $MLT^{-1}$

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*$ML^{-1}T^{-1}$*

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