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1. The fact that the fluorescence wavelength is often much longer than the irradiation wavelength (Stokes shift) is a consequence of which phenomenon?
a) low extinction coefficients (Lambert-Beer law)
b) vertical transitions (Kasha's rule)
c) high ISC rates (El Sayed rule)
d) the Franck–Condon principle
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Answer: d
Explanation: The reason why Stokes shifts occur is the Franck–Condon principle, which states that a change in the electronic state of some molecule caused by the absorption of a photon occurs so rapidly that the motion of the nuclear coordinates during the transition can be neglected. After the electronic transition is complete, the molecule's nuclear coordinates then relax into a lower-energy configuration in response to the change in the electronic wave function.

2. Which of the following is an incorrect statement?
a) First step in photochemistry is excited state (photoexcitation)
b) Photochemical reactions are caused by absorption of ultraviolet only
c) When a molecule or atom in the ground state (S_0) absorbs light, one electron is excited to a higher orbital level
d) it is possible for the excited state S_1 to undergo spin inversion
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Answer: b
Explanation: Photochemical reactions are caused by absorption of ultraviolet, (wavelength from 100 to 400 nm), visible light (400 – 750 nm) or infrared radiation (750 – 2500 nm).

3. Which regions of the light radiations of the visible ultraviolet lying between – wavelength are chiefly concerned in bringing about photochemical reactions?
a) 1000 Å and 2000 Å
b) 1500 Å and 1000 Å
c) 8000 Å and 2000 Å
d) 19000 Å and 12,000 Å
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Answer: c
Explanation: The region of interest for photochemistry is between 8000 Å and 2000 Å of visible and ultraviolet (UV), are only a small part of the full electromagnetic spectrum. Longer wavelengths, e.g., far infrared, tend to cause the vibrational excitation of molecules, which results in heating. Shorter wavelength X-rays cause ionization.

4. Which of the following instruments is used to measure the energy of the monochromatic radiation most accurately?
a) Photoelectric cell
b) Thermopile
c) The potential detector

d) The chemical actinometer
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Answer: b
Explanation: A thermopile is an electronic device that converts thermal energy into electrical energy. It is composed of several thermocouples connected usually in series or, less commonly, in parallel.

5. The molar extinction coefficient of B (MW = 180) is 4 x 10^3 L mol^{-1} cm^{-1}. One-liter solution of C which contains 0.1358 g pharmaceutical preparation of B, shows an absorbance of 0.411 in a 1 cm quartz cell. What is the percentage (w/w) of B in the pharmaceutical preparation?
a) 10.20
b) 13.60
c) 20.40
d) 29.12
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Answer: b

Using: Absorbance = E × b × concentration

$$0.411 = 4 \times 10^3 \times 1 \times \frac{weight\ of\ solute}{molecular\ weight\ of\ solute \times volume\ of\ solution(L)}$$

$$0.411 = 4 \times 10^3 \times \frac{W}{180 \times 1}$$

$$W = \frac{0.411 \times 180}{4 \times 10^3} = 0.018495g$$

$$\%\frac{W}{W} = \frac{0.018495}{0.1358} = 0.1362 \approx 13.62\%.$$

Explanation:

6. What are the appropriate reasons for the deviation from the Beer's law among the following?
(A) Monochromaticity of light
(B) Very high concentration of analyte
(C) Association of analyte
(D) Dissociation of analyte
a) A, B and D
b) B, C and D
c) A, C and D
d) A, B and C
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Answer: b
Explanation: Reasons for derivation from Beer's law are very high concentration of analyte, Association or Dissociation of analyte and Refractive index → Polychromatic light. Monochromaticity of light don't have any effect on Beer's law.

7. A 0.1 M solution of compound A shows 50% transmittance when a cell of 1 cm width is used at λ_1 nm. Another 0.1 M solution of compound B gives the optical density value of

0.1761 using 1cm cell at λ_1 nm. What will be the transmittance of a solution that is simultaneously 0.1 M in A and 0.1 M in B using the same cell and at the same wave length? [log 1.301; log 1.4771; log 50 = 1.699].
a) 33.3%
b) 50%
c) 66.7%
d) 70%
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Answer: a
Explanation: Case I: Transmittance (T1) = 50% = $^{50}/_{100}$ = $^{1}/_{2}$
Case II: Optical density or Absorbance = 0.17610
A_2 = 0.1761
$T_2 = 10^{-A2} = 10^{-0.1761}$ = 0.67.
∴ Net Transmittance 'T' = T1 × T2 = $^{1}/_{2}$ × 0.67 = 0.33 = 33%.

8. Which of the following will result in deviation from Beer's law?
(A) Change in a refractive index of medium
(B) Dissociation of analyte on dilution
(C) Polychromatic light
(D) Path length of cuvette
a) A, B and C
b) B, C and D
c) A, C and D
d) A, B and D
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Answer: a
Explanation: Change in a refractive index of medium, Dissociation of analyte on dilution and Polychromatic light (reflective index) will result in deviation from Beer's law.

9. The quantum efficiency of a photochemical reaction is defined as _____
a) ratio of molecules decomposed in a given time to the number of quanta absorbed in the same time
b) number of 11101ecules decomposed in a given time
c) number or quanta absorbed percent time
d) ratio of' molecules decomposed in a given time to the number of quanta emitted in the same time
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Answer: a
Explanation: According to the definition ratio of molecules decomposed in a given time to the number of quanta absorbed at the same time is the correct option.

10. Which of the following are the reactions in which molecules absorbing light do not themselves react but induce other molecules to react?
a) Free radical reactions
b) Chain reactions
c) Reversible reactions

d) Photosensitized reactions
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Answer: d
Explanation: Photosensitized reactions is the reactions in which molecules absorbing light do not themselves react but induce other molecules to react.