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Please reply yes or no, more than one answer can be yes (+0.5 if correct, otherwise 0)

Quantum number

	yes	no
Energy does not depend on n		
l is always lower than n		
s can be negative		
m_l describes the orbital shape		

Excited state deactivation processes

	yes	no
Are always non radiative		
Can be in the millisecond time scale		
Can produce heat or light		
Are always unimolecular		

Electronic excited states

	yes	no
Are always singlets		
Typically, triplets can be formed by light absorption		
Have lower energy than the ground state		
Are stable		

Lifetime τ

	yes	no
After τ excited state completely disappears		
Typically, is shorter for triplets than for singlets		
Short τ is needed for bimolecular processes		
For singlet is often in the ns time scale		

Jablonski diagrams

	yes	no
Typically represent only one electronic state		
First excited singlet is lower in energy than first excited triplet		
Intersystem crossing goes from singlet to singlet		
Intersystem crossing goes from triplet to triplet		

Multiplicity

	yes	no
Singlet to singlet transitions are forbidden		
Triplet to triplet transitions are forbidden		
Triplet to singlet transitions are allowed		
Typically, excited state singlet of a chromophore interacts with O2		

Absorption of light

	yes	no
Red pigments absorb red light		
Typically leads to the direct formation of a triplet		
Occurs in the ns time scale		
For molecules spectrum is made by lines		

Photo-isomerization

	yes	no
Is not activated by light		
May involve rotation around a double bond		
Is not involved in vision		
Can go either from trans to cis or form cis to trans		

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Dye molecules

	yes	no
Absorption maximum does not depend on the substituents		
Can be organic or inorganic		
Are soluble in the used matrix		
Are less photostable than iron-oxides		

Distorted excited states

	yes	no
Peak of absorption is lower in energy than the pure electronic transition		
Peak of fluorescence is lower in energy than the pure electronic transition		
Absorption of light produces a breaking of bonds		
Minimum of energy of the ground and excited state is for the same geometry		

Non distorted (nested) excited states

	yes	no
Absorption band is symmetric		
Fluorescence band is not symmetric		
Vibrational 0-0 transition is not possible		
After light absorption there is always vibrational relaxation		

Electronic excited states

	yes	no
Geometry can be very different from ground state		
There is only one excited state per molecule		
Can be produced with a small increase of the temperature		
Are typical of a molecule in the dark		

Exercise (9 points)

Draw the microstates for O_2. Find the electronic states. Show the order of energy of the states. What is the multiplicity of the ground state? What is the multiplicity of the first excited state? Is transition to this last state possible by absorption of light by O_2.