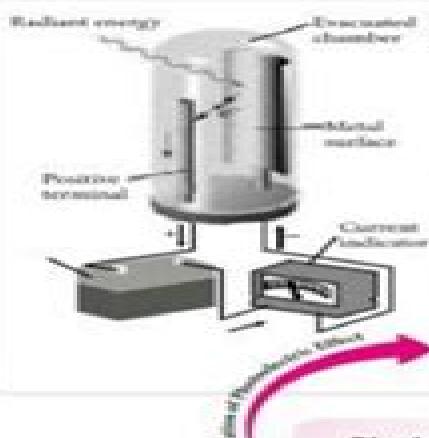


# QUANTUM THEORY OF LIGHT

## BRAIN MAP CLASS XII



### Photoelectric Cell

- An electrical device which converts light energy into electrical energy, is called as photocell or photoelectric cell.
- It works on the principle of photo-electric emission of electrons.

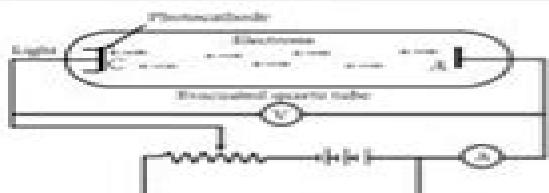


### Photoelectric Effect

- The phenomenon of emission of electrons from a metal surface when an electromagnetic wave of suitable frequency is incident on it is called photoelectric effect.

### Photoelectric Equation

- $E = K_{\max} + \phi_0$   
where  $\phi_0$  = work function of metal,  
 $E$  = energy of incident light,  
 $K_{\max}$  = maximum kinetic energy of electrons
- $\frac{1}{2}mv_{\max}^2 = h(v - v_0) = hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$   
where,  $\lambda_0 = \frac{hc}{\phi_0}$  = threshold wavelength



### Basic Quantum Theory of Light

- According to Planck, the energy of a photon,  $E = \hbar\nu$  ;  

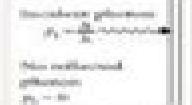
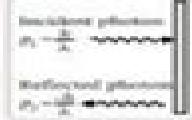
$$E = \hbar\nu = \frac{hc}{\lambda} = \frac{1240}{\lambda(\text{in nm})} \text{ eV}$$
- Momentum of photons,  $p = \frac{E}{c} = \frac{hc}{c} = \frac{h}{\lambda}$
- If source is 100% efficient, then the number of photons emitted per second by the source can be given by  

$$\text{Power of source} = \frac{P}{E} = \frac{P}{\hbar\nu} = \frac{PA}{hc}$$
- The energy crossing per unit area per unit time perpendicular to the direction of propagation is called the intensity of a wave.  
 $I = E/A = P/A$
- Force exerted on perfectly reflecting surface  

$$F = \frac{\Delta P}{t} = \frac{2Nh}{t\lambda} = n\left(\frac{2h}{\lambda}\right) = \frac{2P}{c}$$
  
 $\text{Pressure} = \frac{F}{A} = \frac{2P}{cA} = \frac{2I}{c}$
- Force exerted on perfectly absorbing surface  

$$F = \frac{\Delta P}{t} = \frac{Nh}{t\lambda} = n\left(\frac{h}{\lambda}\right) = \frac{P}{c}$$
  
 $\text{Pressure} = \frac{F}{A} = \frac{P}{cA} = \frac{I}{c}$
- When a beam of light is incident at an angle  $\theta$  on perfectly reflector surface then force exerted on the surface,  

$$F = \frac{2P}{c} \cos\theta = \frac{2I}{c} \cos\theta$$
  
 $\text{Pressure} = \frac{2I}{cA} \cos\theta$

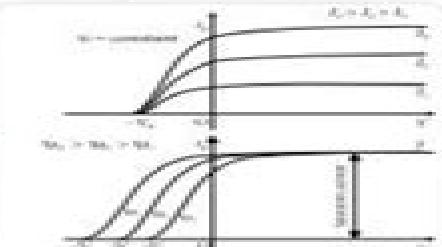


### PARTICLE NATURE OF RADIATION

### Conclusions of Experimental Study of Photoelectric Effect

- Photo-current is directly proportional to the intensity of incident light, i.e.,  $I_p \propto I$ .  
(At constant frequency  $v$  and potential  $V$ )
- At constant frequency and intensity, the minimum negative potential at which the photocurrent becomes zero is called stopping potential ( $V_0$ ).
- At stopping potential  $V_0$ ,  $K_{\max} = eV_0$
- For a given frequency of the incident radiation, the stopping potential is independent of its intensity.
- The stopping potential varies linearly with the frequency of incident radiation but saturation current value remains constant for a fixed intensity of incident radiation.

- Quantum efficiency =  $\frac{n_e}{n_{ph}}$   
 $n_e$  = number of electron emitted per second  
 $n_{ph}$  = total number of photon incident per second



# Study Guide Quantum Theory

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web dec 16 2019 squared said there might be 1 2 more pictures released since my last update and i no longer have access to jp s site at the moment i ll re up in a few

**the butterfly life cycle celebrate planet earth** - Aug 03 2022

web jan 3 2019 life cycle teacher s guide 3rd grade science unit earthsbirthday org butterfly lab earth s birthday project cultivates hope for the future by inspiring including space to record what we ve learned during the unit diagram diagram of a butterfly life cycle on the right time 30 minutes materials newsprint markers post it

*third grade life science grade standards supporting skills and* - Jun 01 2022

web describe life cycles including growth and metamorphosis of familiar organisms describe how living things are supported by the environment yet are diverse and interdependent describe ways humans impact air water and habitat quality describe how fossils provide evidence of change

**fun 3rd grade life cycles and traits activities** - May 12 2023

web mar 6 2023 to kick off this unit students will study plant and animal life cycles and how they all have similar characteristics birth growth reproduction death use the mini books to teach your students about the similarities between all animal life cycles and all plant life cycles create a spinning wheel to study the life cycle of an apple and a frog

grade 3 model science unit 5 continuing the cycle chester - Mar 10 2023

web in third grade students learn that the changes an organism goes through during its life form an observable pattern although different types of organisms have unique and diverse life cycles they follow a pattern of birth growth reproduction and death

**life cycles animals and plants grade 3 life science games** - Dec 27 2021

web grade 3 science life science life cycles life cycles animals and plants learn the different stages of life cycles in plants and animals pay what you can drag and drop the stages into the correct sequence instructions 1 look at the name given for each stage 2 drag and drop the picture that corresponds to that stage

3rd grade life science plants unit unc institute for the - Oct 05 2022

web sep 3 2019 3rd grade life science plants unit developed for chapel hill carrboro city schools northside elementary school outdoor wonder learning owl initiative unless otherwise noted activities written by lauren greene sarah yelton dana haine toni stadelman center for public engagement with science unc institute for the environment

**life cycles lesson plan for 3rd grade lesson planet** - Sep 04 2022

web this life cycles lesson plan also includes rubric join to access all included materials third graders work in cooperative groups to gather information create their product and present to an audience the groups use all sources of media to gather information including electronic encyclopedias and the internet they use appleworks claris draw

**plant life cycle stages 3rd grade science pbl teachervision** - Apr 30 2022

web introduce your 3rd grade science students to the plant lifecycle with this engaging and hands on project based learning unit students will learn all about the life cycles of plants perform research and presentations on plant adaptations design a dispersion model and show what they know by designing and creating a super plant that can

3rd grade life cycles unit teaching resources teachers pay - Jan 08 2023

web browse 3rd grade life cycles unit resources on teachers pay teachers a marketplace trusted by millions of teachers for original educational resources

**life cycles and traits of organisms a ngss 3rd grade unit 3 ls1 tpt** - Nov 06 2022

web this is an entire learning unit for the beginning of 3rd grade that covers life cycles and inherited non inherited traits  
*science a z life cycles grades 3 4 life science unit* - Jul 14 2023

web during its life cycle an organism goes through physical changes that allow it to reach adulthood and produce new organisms since these changes are common within a species they can be grouped into stages of development the unit life cycles addresses the life cycles of plants and animals including humans

**life cycles and traits a 3rd grade unit the resource teachers** - Aug 15 2023

web apr 7 2019 this life cycles and traits unit was my first attempt at creating a whole unit of learning it correlates to the next generation science standards 3 ls1 1 3 ls3 1 and 3 ls3 2 looking back on it now i see lessons i already want to improve but for now you can find the unit for free by clicking on the link below

**3rd grade life cycles growth and development of organisms tpt** - Dec 07 2022

web 3rd grade life cycles growth and development of organisms ngss aligned this comprehensive science unit offers an in depth exploration of the life cycles of plants animals and insects through 10 engaging lessons complete with powerpoint presentations detailed lesson plans and hands on activities

[lesson plan life cycle by nichole hughes and darby feldwinn](#) - Feb 09 2023

web lesson plan life cycle by nichole hughes and darby feldwinn target grade 3rd teacher prep time 60 minutes lesson time 4 hours and 5 minutes not including the life cycle journal we recommend doing this lesson over five days 5 hours and 20 minutes life cycle journal this must be spread out over eight weeks recording data twice a

**life cycles of plants and animals science stations for third grade** - Jun 13 2023

web an in depth look at the plant and animal life cycle science stations below is information and details about each of the plant and animal life cycle science stations which address ngss 3 ls1 b and include concepts such as animal life cycles plant life cycles and parts of

*ngss 3rd grade life cycles traits and inheritance unit tpt* - Jul 02 2022

web this bundle includes all 4 units for third grade you will find resources for inputinquiry chartsobservation chartsbig book ppt and printable pictorial and comparative input chart templates 16 total socialitycontinental driftgeologic time scalenatural selectionadaptationsecosystem dynamicsforces o

**a third grade thematic unit on the life cycle of plants** - Mar 30 2022

web may 23 2010 a 3rd grade thematic unit on the life cycle of plants will help them to observe and understand their environment in a better way read on to learn more students in elementary classes like to observe their environment

*3 life cycles and traits the wonder of science* - Apr 11 2023

web life cycles and traits 3 ls1 1 plant and animal life cycles develop models to describe that organisms have unique and diverse life cycles but all have in common birth growth reproduction and death 3 ls3 1 inheritance and variation of traits  
timeline of life cycle stages third 3rd grade science standards - Feb 26 2022

web dec 26 2014 create a timeline to depict the changes that occur during an organism s life cycle 0307 4 2 links verified 12 26 2014 butterfly life cycle from enchanted learning butterfly life cycle lesson plan with nine activities this expired page is from the internet archive known as the wayback machine four stages of the butterfly life cycle short

*life cycle of plants and animals 5e unit plan for third grade* - Jan 28 2022

web life cycle of plants and animals 5e unit plan for third grade 9 90 this life cycle of plants and life cycle of animals 5e unit plan is an inquiry based unit using the 5e model lesson plan it focuses on investigating life cycles and developing models to describe the unique and diverse life cycle of organisms