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GPT – Physics Handbook (Part 2)

Why does the sky appear dark instead of blue to an astronaut?

The sky appears dark instead of blue to an astronaut because there is no atmosphere in the outer space that can scatter the sunlight. As the sunlight is not scattered, no scattered light reach the eyes of the astronauts and the sky appears black to them

Why does the Sun appear reddish early in the morning?

During sunrise, the light rays coming from the Sun have to travel a greater distance in the earth's atmosphere before reaching our eyes. In this journey, the shorter wavelengths of lights are scattered out and only longer wavelengths are able to reach our eyes. Since blue colour has a shorter wavelength and red colour has a longer wavelength, the red colour is able to reach our eyes after the atmospheric scattering of light. Therefore, the Sun appears reddish early in the morning

Explain why the planets do not twinkle?

Planets do not twinkle because they appear larger in size than the stars as they are relatively closer to earth. Planets can be considered as a collection of a large number of point-size sources of light. The different parts of these planets produce either brighter or dimmer effect in such a way that the average of brighter and dimmer effect is zero. Hence, the twinkling effects of the planets are nullified and they do not twinkle

Why do stars twinkle?

Stars emit their own light and they twinkle due to the atmospheric refraction of light. Stars are very far away from the earth. Hence, they are considered as point sources of light. When the light coming from stars enters the earth's atmosphere, it gets refracted at different levels because of the variation in the air density at different levels of the atmosphere. When the star light refracted

by the atmosphere comes more towards us, it appears brighter than when it comes less towards us. Therefore, it appears as if the stars are twinkling at night.

What happens to the image distance in the eye when we increase the distance of an object from the eye?

Since the size of eyes cannot increase or decrease, the image distance remains constant. When we increase the distance of an object from the eye, the image distance in the eye does not change. The increase in the object distance is compensated by the change in the focal length of the eye lens. The focal length of the eyes changes in such a way that the image is always formed at the retina of the eye.

Why is a normal eye not able to see clearly the objects placed closer than 25 cm?

A normal eye is unable to clearly see the objects placed closer than 25 cm because the ciliary muscles of eyes are unable to contract beyond a certain limit. If the object is placed at a distance less than 25 cm from the eye, then the object appears blurred and produces strain in the eyes

What is the far point and near point of the human eye with normal vision?

The near point of the eye is the minimum distance of the object from the eye, which can be seen distinctly without strain. For a normal human eye, this distance is 25 cm. The far point of the eye is the maximum distance to which the eye can see the objects clearly. The far point of the normal human eye is infinity

What is meant by power of accommodation of the eye?

When the ciliary muscles are relaxed, the eye lens becomes thin, the focal length increases, and the distant objects are clearly visible to the eyes. To see the nearby objects clearly, the ciliary muscles contract making the eye lens thicker. Thus, the focal length of the eye lens decreases and the nearby objects become visible to the eyes. Hence, the human eye lens is able to adjust its focal length to view both distant and nearby objects on the retina. This ability is called the power of accommodation of the eyes

What does an electric circuit mean?

A continuous and closed path of an electric current is called an electric circuit. An electric circuit consists of electric devices, source of electricity and wires that are connected with the help of a switch

Calculate the number of electrons constituting one coulomb of charge

One electron possesses a charge of $1.6 \times 10^{-19}\text{C}$, i.e., $1.6 \times 10^{-19}\text{C}$ of charge is contained in 1 electron.

1 C of charge is contained in $1/1.6 \times 10^{-19} = 6.25 \times 10^{18} = 6 \times 10^{18}$
Therefore, 6×10^{18} electrons constitute one coulomb of charge

How much energy is given to each coulomb of charge passing through a 6 V battery?

The energy given to each coulomb of charge is equal to the amount of work which is done in moving it. Now we know that,

Potential difference = Work Done/Charge

Work done = Potential difference \times charge Where,

Charge = 1 C and Potential difference = 6 V

Work done = $6 \times 1 = 6$ Joule.

On what factors does the resistance of a conductor depend?

The resistance of a conductor depends upon Length of the conductor, Cross-sectional area of the conductor, Material of the conductor and Temperature of the conductor

Will current flow more easily through a thick wire or a thin wire of the same material, when connected to the same source? Why?

The current will flow more easily through thick wire. It is because the resistance of a conductor is inversely proportional to its area of cross - section. If thicker the wire, less is resistance and hence more easily the current flows

Why are coils of electric toasters and electric irons made of an alloy rather than a pure metal?

The resistivity of an alloy is higher than the pure metal. Moreover, at high temperatures, the alloys do not melt readily. Hence, the coils of heating appliances such as electric toasters and electric irons are made of an alloy rather than a pure metal

What are the advantages of connecting electrical devices in parallel with the battery instead of connecting them in series?

There is no division of voltage among the appliances when connected in parallel. The potential difference across each appliance is equal to the supplied voltage. The total effective resistance of the circuit can be reduced by connecting electrical appliances in parallel.

Why does the cord of an electric heater not glow while the heating element does?

The heating element of the heater is made up of alloy which has very high resistance so when current flows through the heating element, it becomes too hot and glows red. But the resistance of cord which is usually of copper or aluminium is very low so it does not glow.

Why does a compass needle get deflected when brought near a bar magnet?

A compass needle is a small bar magnet. When it is brought near a bar magnet, its magnetic field lines interact with that of the bar magnet. Hence, a compass needle shows a deflection when brought near the bar magnet.

List the properties of magnetic lines of force

The properties of magnetic lines of force are (a) Magnetic field lines emerge from the north pole. (b) They merge at the south pole. (c) The direction of field lines inside the magnet is from the south pole to the north pole. (d) Magnetic lines do not intersect with each other.

Why don't two magnetic lines of force intersect each other?

If two field lines of a magnet intersect, then at the point of intersection, the compass needle points in two different directions. This is not possible. Hence, two field lines do not intersect each other.

State Fleming's left-hand rule.

Fleming's left hand rule states that if we arrange the thumb, the centre finger, and the forefinger of the left hand at right angles to each other, then the thumb points towards the direction of the magnetic force, the centre finger gives the direction of current, and the forefinger points in the direction of magnetic field.

What is the principle of an electric motor?

The working principle of an electric motor is based on the magnetic effect of current. A current-carrying loop experiences a force and rotates when placed

in a magnetic field. The direction of rotation of the loop is given by the Fleming's left-hand rule.

What is the role of the split ring in an electric motor?

The split ring in the electric motor acts as a commutator. The commutator reverses the direction of current flowing through the coil after each half rotation of the coil. Due to this reversal of the current, the coil continues to rotate in the same direction

State the principle of an electric generator

An electric generator works on the principle of electromagnetic induction. It generates electricity by rotating a coil in a magnetic field

What precaution should be taken to avoid the overloading of domestic electric circuits?

The precautions that should be taken to avoid the overloading of domestic circuits are

(a) Too many appliances should not be connected to a single socket. (b) Too many appliances should not be used at the same time. (c) Faulty appliances should not be connected in the circuit. (d) Fuse should be connected in the circuit

Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?

The direction of magnetic field is given by Fleming's left hand rule. Magnetic field inside the chamber will be perpendicular to the direction of current (opposite to the direction of electron) and direction of deflection/force i.e., either upward or downward. The direction of current is from the front wall to the back wall because negatively charged electrons are moving from back wall to the front wall. The direction of magnetic force is rightward. Hence, using Fleming's left hand rule, it can be concluded that the direction of magnetic field inside the chamber is downward

A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is (i) pushed into the coil, (ii) withdrawn from inside the coil, (iii) held stationary inside the coil?

A current induces in a solenoid if a bar magnet is moved relative to it. This is the principle of electromagnetic induction.

(i) When a bar magnet is pushed into a coil of insulated copper wire, a current is induced momentarily in the coil. As a result, the needle of the galvanometer deflects momentarily in a particular direction.

(ii) When the bar magnet is withdrawn from inside the coil of the insulated copper wire, a current is again induced momentarily in the coil in the opposite direction. As a result, the needle of the galvanometer deflects momentarily in the opposite direction.

(iii) When a bar magnet is held stationary inside the coil, no current will be induced in the coil. Hence, galvanometer will show no deflection

When does an electric short circuit occur?

If the resistance of an electric circuit becomes very low, then the current flowing through the circuit becomes very high. This is caused by connecting too many appliances to a single socket or connecting high power rating appliances to the light circuits. This results in a short circuit. When the insulation of live and neutral wires undergoes wear and tear and then touches each other, the current flowing in the circuit increases abruptly. Hence, a short circuit occurs

What is the function of an earth wire? Why is it necessary to earth metallic appliances?

The metallic body of electric appliances is connected to the earth by means of earth wire so that any leakage of electric current is transferred to the ground. This prevents any electric shock to the user. That is why earthing of the electrical appliances is necessary

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