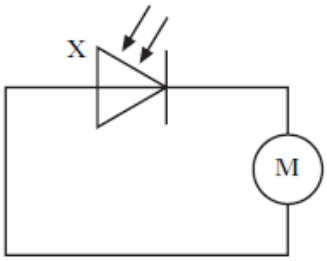
Unit 3 – Electricity
Section 5 - Conductors, Semiconductors & Insulators
Section 6 – p-n Junctions

2007 **18.** In the following circuit, component X is used to drive a motor.



Which of the following gives the name of component X and its mode of operation?

	Name of component X	*Mode of operation*
A	light-emitting diode	photoconductive
B	light-emitting diode	photovoltaic
C	photodiode	photoconductive
D	photodiode	photovoltaic
E	op-amp	inverting

2008 **18.** The letters **X**, **Y** and **Z** represent three missing words from the following passage.

Materials can be divided into three broad categories according to their electrical resistance.

..... **X** *..... have a very high resistance.*

..... **Y** *..... have a high resistance in their pure form but when small amounts of certain impurities are added, the resistance decreases.*

..... **Z** *..... have a low resistance.*

Which row in the table shows the missing words?

	X	**Y**	**Z**
A	conductors	insulators	semi-conductors
B	semi-conductors	insulators	conductors
C	insulators	semi-conductors	conductors
D	conductors	semi-conductors	insulators
E	insulators	conductors	semi-conductors

2009 **17.** A student writes the following statements about p-type semiconductor material.

I Most charge carriers are positive.

II The p-type material has a positive charge.

III Impurity atoms in the material have 3 outer electrons.

Which of these statements is/are true?

A I only

B II only

C I and II only

D I and III only

E I, II and III

2009 **18.** A p-n junction diode is forward biased.

Positive and negative charge carriers recombine in the junction region. This causes the emission of

A a hole

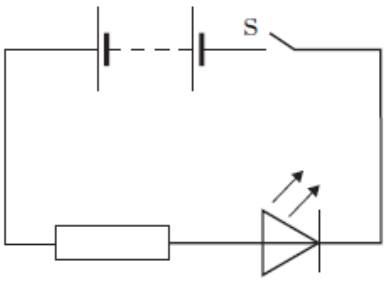
B an electron

C an electron-hole pair

D a proton

E a photon.

2010 **16.** An LED is connected as shown.



When switch S is closed

A the p-n junction is reverse biased and free charge carriers are produced which may recombine to give quanta of radiation

B the p-n junction is forward biased and positive and negative charge carriers are produced by the action of light

C the p-n junction is reverse biased and positive and negative charge carriers are produced by the action of light

D the p-n junction is forward biased and positive and negative charge carriers may recombine to give quanta of radiation

E the p-n junction is reverse biased and positive and negative charge carriers may recombine to give quanta of radiation.

2011 **18.** In an n-type semiconductor

A the majority charge carriers are electrons

B the majority charge carriers are holes

C the majority charge carriers are protons

D there are more protons than electrons

E there are more electrons than protons.

2012 Revised **20.** The letters **X**, **Y** and **Z** represent missing words in the following passage.

Solids can be categorised as conductors, semiconductors or insulators.

*In . . . **X** . . . the energy gap between the valence band and the conduction band is . . . **Y** . . . , allowing . . . **Z** . . . conduction to take place at room temperature.*

Which row in the table shows the missing words?

	X	Y	Z
A	conductors	large	no
B	semiconductors	small	no
C	conductors	large	some
D	semiconductors	small	some
E	insulators	small	no

2013 **18.** A student reads the following passage in a physics dictionary.

"*. . . is a solid state device in which positive and negative charge carriers are produced by the action of light on a p-n junction.*"

The passage describes

A a thermistor

B a MOSFET

C a photodiode

D a laser

E an LED.

2013 Revised **20.** A crystal of silicon is "doped" with arsenic. This means that a small number of the silicon atoms are replaced with arsenic atoms.

The effect of the doping on the crystal is to

A make it into a photodiode

B make it into an insulator

C increase its resistance

D decrease its resistance

E allow it to conduct in only one direction.

2014 18. A sample of pure semiconductor can be doped to form an n-type semiconductor.

Which row in the table describes the majority charge carriers in the n-type semiconductor and how the resistance of the n-type semiconductor compares with that of the pure semiconductor?

	Majority charge carriers	*Resistance of n-type semiconductor compared to resistance of pure semiconductor*
A	negative	greater
B	positive	greater
C	negative	less
D	positive	less
E	negative	unchanged

2014 19. A student makes the following statements about p-n junction devices.

I In solar cells, a potential difference is produced when photons are incident on the junction.

II The photovoltaic effect occurs in solar cells.

III In LEDs, photons are emitted from the junction when a current is passed through it.

Which of these statements is/are correct?

A I only

B III only

C I and II only

D I and III only

E I, II and III

2014 Revised 18. The letters **X**, **Y** and **Z** represent missing words from the following passage.

Solids can be divided into 3 broad categories: conductors, insulators and semiconductors.

*In .....**X**..... the conduction band is not completely full and this allows electrons to move easily.*

*In .....**Y**..... the valence band is full.*

*In .....**Z**..... electrons can move from the valence to the conduction band at room temperature.*

Which row in the table shows the missing words?

	X	**Y**	**Z**
A	conductors	insulators	semiconductors
B	semiconductors	insulators	conductors
C	insulators	semiconductors	conductors
D	conductors	semiconductors	insulators
E	insulators	conductors	semiconductors

2015 19. A student makes the following statements about energy bands in different materials.

I In metals the highest occupied energy band is not completely full.

II In insulators the highest occupied energy band is full.

III The gap between the valence band and conduction band is smaller in semiconductors than in insulators.

Which of these statements is/are correct?

A I only

B II only

C I and II only

D I and III only

E I, II and III

2017 19. A student makes the following statements about conductors, insulators and semiconductors.

I In conductors, the conduction band is completely filled with electrons.

II In insulators, the gap between the valence band and the conduction band is large.

III In semiconductors, increasing the temperature increases the conductivity.

Which of these statements is/are correct?

A I only

B II only

C III only

D I and II only

E II and III only