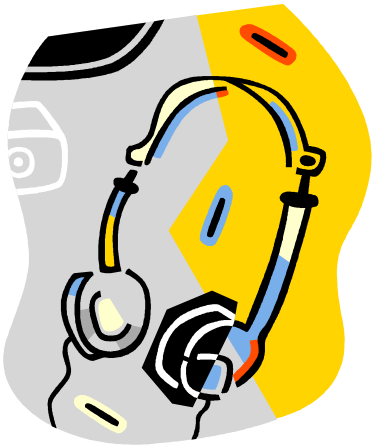
centre de développement pédagogique
pour la formation générale en science et technologie

EARPHONES



STUDENT BOOKLET

October 2007

WORKING DOCUMENT

Context

Like many youths of your age, you have found a student job. You work evenings in an electronics store. Sometimes, clients bring back their defective earphones and ask for them to be repaired. Today, your boss has assigned you the task of repairing some of them.

You must understand the functioning principles of earphones to be able to find out what is defective.

Mandate

Each team must:

1. Find several defects in the earphones. Set forth the strategies used and imagine a way to repair them.
2. Familiarise yourself with the theoretical notions involved.
3. Determine the function of each of the components of the earphones.
4. Set forth the functioning principles of the earphones (principles diagram and explanation of the function).

How must you go about finding the defects in the earphones? What has to be done?

Instructions

1. Form teams of 4 people.
2. Go to the work station designated by the teacher.
3. At this station, the team must become familiar with the theoretical notions by means of the section called **"Theoretical notions observation card"**.
4. The team must then go to the next work station in order to be faced with new theoretical notions (each team will have to work through all 8 stations set up in the lab).
5. When all the teams have finished their observations, a set of earphones will be placed at each workstation. You must then analyse these earphones by means of the section called "**Components analysis card**".
6. Next, you must complete the section called **"Principles diagram and explanation of functionality"**.
7. The team must next locate the defect in the earphones at this station by completing the table called **"Study of anomalies"**.
8. Finally, the team will move to the next station to be faced with a different set of defective earphones (each team will work through all 8 stations set up in the lab).

THEORICAL NOTIONS OBSERVATIONS CARD

Station #	Notions	Materiel
1	**Objective: Differentiate between insulators and conductors** **Track: Through which substances do electrical currents travel?**	• **1 multi-metre (optional)** • **1 battery (9 V)** • **1 battery connector (9 V)** • **2 wires** • **1 light bulb (9 V)** • **X samples**
My observations about theoretical notions (what I need to remember)		

Station #	Notions	Material
2	**Objective: Identify the factors that influence the conductibility of a conductor.** **Track: Through which samples does the current pass best?**	• **1 «D» battery (1,5 V)** • **battery holder** • **3 wires** • **1 light bulb (3.6 V)** • **3 samples of different material (steel, copper, nickel-chromium)** • **3 samples of different length (10, 50 100 cm)** • **3 samples of different size (#26, #22, #18)**
My observations about theoretical notions (what I need to remember)		

Station #	Notions	Materiel
3	**Objective: To determine the configuration and the direction of the magnetic field of a permanent magnet.** **Tracks: Do not put the filaments directly on the magnet. The coloured side of the needle of the compass is a north pole. How is the compass pointed close to the magnet? Where is the north pole of the magnet? How are the filaments positioned over the magnet?**	• **1 magnet** • **1 compass** • **1 «salt shaker» for iron filaments** • **1 piece of cardboard to hold the filaments**
My observations about theoretical notions (what I need to remember)		

Station #	Notions	Materiel
4	**Objective: Study the magnetic field and the forces generated by two permanent magnets.** **Tracks: Do not put the filaments directly on the magnet. The coloured side of the needle of the compass is a north pole. How is the compass pointed close to the magnet? Where is the north pole of the magnet? How are the filaments positioned over the magnet?**	• **2 permanent magnets** • **1 piece of wood to be used as a support** • **1 compass** • **1 «salt shaker» for iron filaments** • **1 piece of cardboard to hold the filaments**
My observations about theoretical notions (what I need to remember)		

Station #	Notions	Materiel
5	**Objective: To verify the presence and the direction of a magnetic field close to a straight wire with current travelling through it.** **Tracks: Is a compass influenced by a wire with current travelling through it? If so, where does the compass point close to this conductor? Where is the north pole?**	• **1 power source (~5 A)** • **2 electrical wires** • **1 copper conductor (#14)** • **1 compass**
My observations about theoretical notions (what I need to remember)		

Station #	Notions	Materiel
6	**Objective: Study the field and magnetic poles generated by an electrical current traveling through a solenoid.** **Tracks: Where does the compass point close to the solenoid? Where is the north pole? What does the magnetic field of a solenoid look like?**	• **1 power source (~5 A)** • **2 electrical wires** • **1 copper solenoid (#14)** • **1 compass**
My observations about theoretical notions (what I need to remember)		

Station #	Notions	Materiel
7	**Objective: Determine the effect of the nature of the core on the solenoid's magnetic field.** **Tracks: Adjust the power source to maximum and connect the solenoid. How many paper clips can be attracted by the solenoid into which you have placed the copper core?**	• **1 power source (~5 A)** • **2 electrical wires** • **1 polished Cu solenoid #26 (150 whorls)** • **1 box of paper clips** • **6 cores (iron, copper, aluminium, wood…)**
My observations about theoretical notions (what I need to remember)		

Station #	Notions	Materiel
8	**Objective: Determine the effect of a variation in the number of whorls on a magnetic field of a solenoid.** **Tracks: Insert the iron core into the solenoid. Adjust the current to 2 amperes for each solenoid. How many paper clips can each solenoid attract?**	• **1 power source** • **1 ampere meter (multi-meter)** • **1 soft iron core** • **1 box of paper clips** • **3 electrical wires** • **1 #26 Cu solenoid with 150 whorls** • **1 #26 Cu solenoid with 100 whorls** • **1 #26 Cu solenoid with 50 whorls**
My observations about theoretical notions (what I need to remember)		

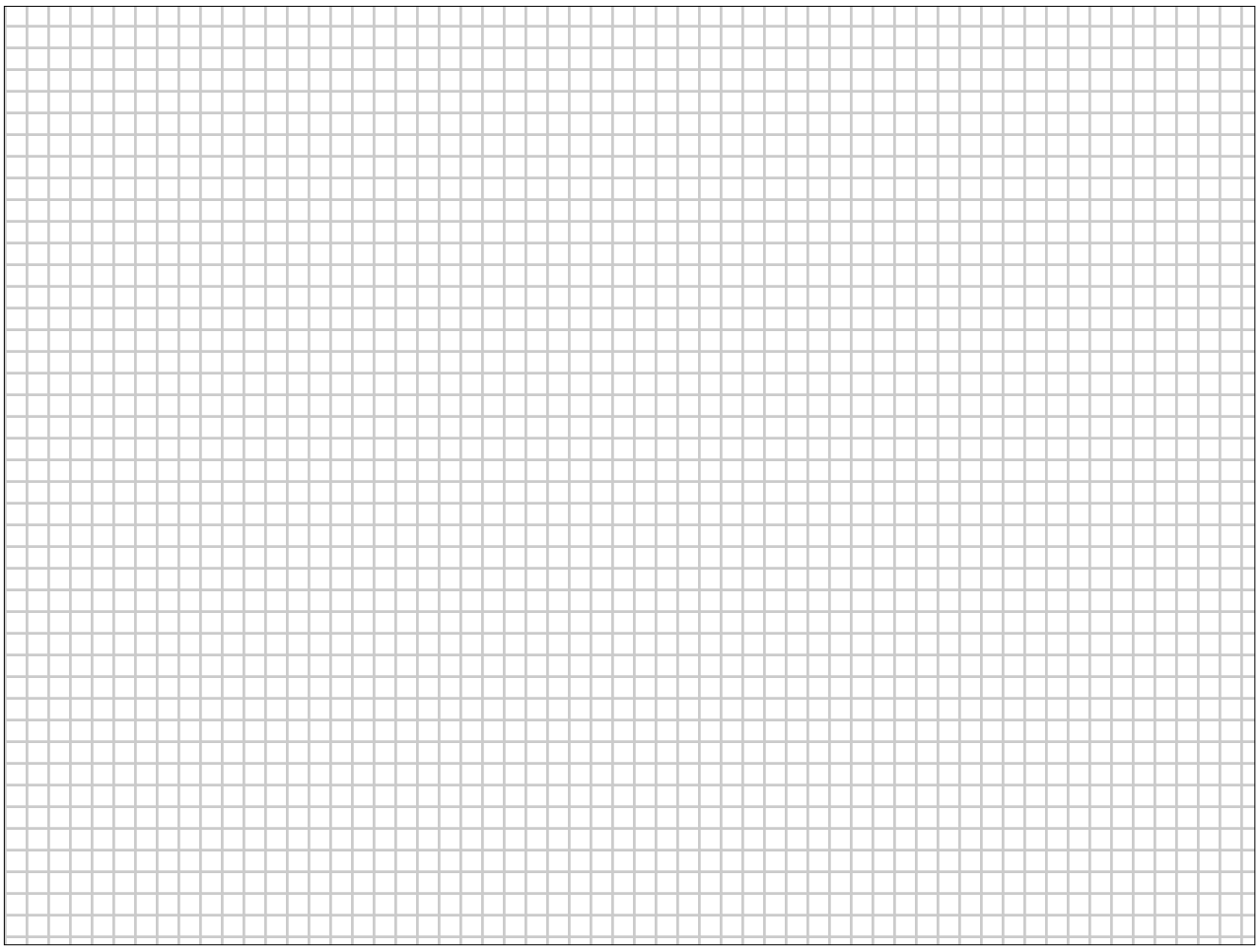
How will the theoretical notions you have just explored help you to analyse the earphones and determine their defects?

COMPONENTS ANALYSIS CARD

#	Components	Function of components (concepts, models, theories)

PRINCIPLES DIAGRAM AND EXPLANATION OF FUNCTIONALITY

Principles diagram for earphones



Explanation of earphones' functionality

STUDY OF EARPHONES' ANOMALIES		
Station #	**Defect**	**Suggested repair**
1		
*** 2**		
*** 3**		
4		
5		
*** 6**		
*** 7**		
8		

***Means these earphones work. You must find the anomaly that makes them perform poorly.**

INDIVIDUAL AND PLENARY REFEXION

Discussion tracks

1. Through which source (internet, dictionary, manuals, etc.) did you find your information about theoretical notions (scientific and technological concepts)?
2. Through which source did you find the information regarding the functionality of earphones?
3. Which strategies or methods did you use to locate the defects in the different sets of earphones?
4. Do you think you possess the necessary qualities to work in the field of electronics repair?
5. If your earphones became defective, would you buy another pair or would you try to have them repaired? Justify your choice, keeping in mind: the environment, salaries and working conditions of foreign workers, cost and repercussions of transportation.
6. Identify the impact of the use of earphones on the lives of individuals in our society.

MY NOTES