The use of conceptual change texts as class material in the teaching of "sound" in physics

Gülbin ÖZKAN

Dokuz Eylül University, Graduate School of Educational Sciences İzmir/ TURKEY

E-mail: gulbn.ozkan@gmail.com;

Gamze SEZGİN SELÇUK

Dokuz Eylül University, Department of Secondary Science and Mathematics Education İzmir/ TURKEY

E-mail: gamze.sezgin@deu.edu.tr

Received 31 Oct., 2012
Revised 13 Jun., 2013

Contents

- Abstract
- Introduction
- Methodology
- Teaching Design
  - Instrument Design
- Discussion and conclusion
- Limitations and Recommendations
- References
- Appendix
  - A (Student responses for text 1)
  - B (student responses for text 2)

Abstract

Misconceptions are the number one factor leading students to failure when studying physics. To teach physics effectively, misconceptions must be spotted and overcome. Conceptual change texts are of great use in identifying and dealing with fallacies. Such texts can help physics teachers diagnose student misconceptions and the reasons for these, and also assist the teacher in explaining the scientific truths that should replace the misconceptions. However, the preparation process for this is quite challenging. This study presents two examples of conceptual change texts that physics teachers will benefit from throughout the teaching/learning process. The texts were tried out on two groups—the first group with elementary school eighth grade students (n=12) and the second with middle school ninth-graders (n=15). Pilot studies have shown that these tools can be very helpful with eighth and ninth grade students. A study concerning the use of conceptual change texts in the teaching of "sound" in physics has not been found in any current literature. Hence, it is believed that these texts about "sound," an often misunderstood subject in physics, are very useful class materials that can enable students to learn meaningfully. Furthermore, the texts are also practical materials that can be used in crowded classrooms.

Keywords: misconceptions, conceptual change text, physics, sound

Introduction

Concepts are very important in physics. Misconceptions obstruct the assimilation of acquired knowledge. To avoid this, and for meaningful learning to take place, incorrect information needs to be identified, revised, and replaced. This is called the "Conceptual Change Process" (Smith, Blakeslee and Anderson, 1993).

The "Conceptual Change Approach" was set forth by Posner, Strike, Hewson and Gertzog (1982). This approach represents a perspective that is grounded on Piaget and Zeitgeist's views yet it has been improved by Posner and his colleagues. The purpose of this approach, which is an alternative strategy derived from Piaget's principles of assimilation, regulation and counterbalancing, is to encourage students to remove misconceptions from their minds, and instead learn scientific knowledge (Wang and Andre, 1991; Chambers and Andre, 1997). When assimilating, students compare concepts with their old knowledge, adding more information to restructure

it. Sometimes, however, their old knowledge may be incomplete or incorrect. This is why existing concepts must be revised and redefined. When old knowledge does not match scientific concepts, in other words, when misconceptions develop, students cannot learn effectively. The conceptual change process must thus be considered in order to counterbalance previous misconceptions.

The Conceptual Change Approach developed by Posner et al. (1982) is based on four conditions:

- Dissatisfaction: The student must be dissatisfied with the concept he knows; that is, he must realize that it is inadequate.

- Intelligibility: The new concept must be understandable enough for the student.

- Plausibility: The student must find the new view/concept logical and be able to picture it in his/her mind.

- Fruitfulness: The new notion/concept must be efficient; in other words, the student must be able to solve similar problems with this new concept.

Conceptual change texts, concept cartoons, concept mapping, mind maps and analogies are some of the many conceptual change strategies used in physics education. This study analyzes the strategy of using "conceptual change texts," which are believed to be very efficient (for example, Başer and Geban, 2007; Dilber et al., 2009; Hırça, 2008; She, 2003; Okur, 2009) in identifying and overcoming misconceptions.

Conceptual change texts specify students' misconceptions, clarify their reasons, and explain why they are incorrect by using concrete examples (Guzzetti et al, 1997). These texts always start with a question to activate the misconception in the student's mind. In the next step, the most commonly accepted misconceptions concerning that topic are presented, and evidence is displayed to convince students why they are wrong. Here, the purpose is to enable students to question the concepts and see the inadequacy of what they think they know. When they are able to do this, they are provided with new information, with examples that will replace the misconception in their minds with the correct concept (Pınarbaşı and Canpolat, 2002).

Using conceptual change texts is such an effective teaching strategy that it can be used throughout the teaching-learning process mainly because of its practical aspects. In the review of the literature, it has been observed that most of the studies concerning the effects of conceptual change texts on learning and some affective variables such as attitude, motives, and learning approaches are mostly about optics, electricity, heat and temperature, and motion. These studies are at university level (Altun, Turgut and Buyukkasap, 2007; Baser, 2006; Dilber, 2006), high school level (Dilber et al, 2009; Hırca, 2008; She, 2003) and elementary school level (Başer and Geban, 2007). All the findings in these studies have proved that conceptual text changes are highly effective in teaching concepts.

A scan of the literature was carried out prior to the preparation of the conceptual change texts in this study. A look into the research on sound reveals that students are unaware of different characteristics of sound such as pitch and intensity (Hrepic, 2004; Merino, 1998), that they do not know that a medium is needed for sound to travel, or that the speed sound travels changes according to the type of medium (solid, liquid or gas) (Hrepic, 1998; Wittmann, Steinberg and Redish 2003; Viennot, 2001).

Linder (1992) has stated that students' views concerning the nature of sound and scientific truths show differences and that misconceptualization hinders students from learning about sound meaningfully. The literature lacks conceptual change texts about sound. Hence, this study was designed to fill that gap, and is geared toward researching the efficiency of conceptual change texts in teaching sound. The purpose of the study is to present an example of material (conceptual change texts) that has been specifically prepared to overcome the misconceptions that eighth- and ninth-grade students have about "sound."

Methodology

This pilot study presents two examples of conceptual change texts that physics teachers will benefit from throughout the teaching/learning process. In the first conceptual change text that was prepared, the difference between the two characteristics of sound, pitch and intensity was explained in order to remove confusion. It was explained in the second text that molecules have to vibrate in the medium in order for sound to travel. Students learn the concept of the distance between molecules in the solid, liquid and gas states of matter in the first tier of

elementary school. Since they already had this knowledge, an attempt was made in the study to support the explanations with images in the text so that the students could make the connection between the distance between molecules and the speed of sound.

After the texts were drawn up, the expert opinions of three experienced teachers--one of them a science teacher and the other two physics teachers--were enlisted. The experts confirmed that the texts that had been drawn up were appropriate to the academic level and readiness of the students in the two groups (8th and 9th grades) and matched the students' degree of knowledge. In accordance with the educational program reforms implemented by the Turkish Ministry of National Education in 2004, the Elementary School "Science and Technology Course" syllabus was revised in the light of the spiral educational model approach and subject loads were lightened. The students in both groups were familiar with sound, wavelength, frequency, speed, amplitude, intensity and other related concepts as well as with the animals (i.e., Parakeet and Eagle in "Part 3") mentioned in the conceptual change texts, having studied these previously in the different levels (4th, 5th and 6th grades) of the course known in the elementary school curriculum as "Science and Technology."

To test the prepared texts (including five parts), a pilot study was conducted at two separate schools—one a high school, the other a middle school—in the province of İzmir, Turkey during the fall semester of the 2012-2013 academic year. The texts were tried out on two groups—the first group with elementary school eighth grade students (n=12) and the second with middle school ninth-graders (n=15).

During the pilot study, the students were asked whether there was anything in the texts that they did not understand. No problem was encountered with regard to either the texts or the implementation. It was observed that attendance in the pilot study was high among the students.

In the section on Teaching Design below, an explanation is offered of how the process of teaching and learning is executed in the context of the present study and what factors must be taken into account.

Teaching Design

The teacher starts the teaching-learning process by handing out worksheets that include the first step of the conceptual change texts. Subsequently, the students are told to follow the instructions carefully. Since the purpose of this exercise is to diagnose and overcome the misconceptions the students have, it is of the utmost importance that the teacher recommends that the students study individually, not in pairs or in groups with their friends. After distributing the texts, the teacher may ask a volunteer to read the text aloud. Part 4, where the students are required to give examples, and Part 5, where they are encouraged to discuss the subject, will definitely arouse their interest. Additionally, the students will hear what their friends think about the subject matter, and they will all have a chance to correct their friends' mistakes if any are made. Throughout this period, the teacher must be a guide. He/She must not correct students' mistakes directly, but encourage them to discover the reasons for their mistakes by offering clues. Finally, by the end of the class, the worksheets must be collected from the students and examined one by one.

Instrument Design

The conceptual change text designed is made up of five parts and has been planned in accordance with the conditions of dissatisfaction, intelligibility, plausibility and fruitfulness in the conceptual change approach developed by Posner (1982) et al.

It is recommended that students be given those parts separately so that they cannot read the answer in the next part and change their answers accordingly. This will render the teaching more effective.

The texts to be handed out to students must have only texts and figures in boxes. To increase the practical aspect of the exercise, the texts should be produced in two versions, as a "teacher's copy" and a "student's copy." The latter will be the student's guide. The former will only include the texts containing the knowledge that the students will be taught. While the student's copy has blank boxes, for example, the blank boxes in the teacher's copy may be filled with the correct information. Some examples of the student copies of conceptual change texts are presented below, along with information about the particular step of the conceptual change process and what should be done at that stage.

Part 1

The first part of the texts aims to identify any possible misconceptions students may have. This allows a teacher to understand how a student pictures the concept in his/her mind. The primary objective here is to make students aware that they are lacking some of the knowledge required to answer the questions in that part. It is of the utmost importance that the text in use relates to daily life in some way. This helps students to more easily realize what they do not know. This is called "drawing attention," which is the first part of the dissatisfaction step.

Let's Learn About Sound	
	While listening to music on the radio, Ayşe turned up the volume to the maximum when she heard her favorite song. Just then, her mother told her to turn it down because she was sleeping next door and was disturbed by the noise. So Ayşe had to turn the volume button back to its old position to turn the volume down. What is this action called in daily life? And, what change in which characteristic of sound does this action relate to?
Please answer the question by explaining your reasons. …… …….....	

Part 2

This part features common misconceptions and answers that are scientifically untrue. In other words, this is the stage where disorder is created within the dissatisfaction step. Students are encouraged to think more deeply about the subject. In this step, students' minds are caught up in confusion and uncertainty. When they recognize any one of the stated misconceptions as their own, this arouses their curiosity.

The most common misconception about "sound" is that the concepts of "the level of sound" and of "sound intensity" are the same. What about you? What do you think? Now, read the next text very carefully.

Part 3

After students give the problem a second thought, the scientific truths concerning the subject are explained. That explanation must be very clear and intelligible. It must also be backed up with graphs, charts and images, if necessary, because pictures are very effective visual tools that easily grab the student's attention and make knowledge permanent (Arnheim, 1997).

Let's see if your answer is correct

When the music is turned down, the intensity of the sound changes. The intensity of sound indicates whether that sound is loud or soft. Intensity is the force of energy flowing through a unit area. Sound intensity is measured on the decibel scale. The further one moves away from the source of sound, the lower the decibel. Intense sound is similar to the sound wave produced by a parakeet, whereas sound at a low decibel is similar to that produced by an eagle (Figure 1 and Figure 2). Sound at high amplitude is known as an "intense sound" whereas sound at low amplitude is called a "dull sound". "Sound pitch level," on the other hand, shows whether it is a chirp or a deep vocalization.

While a high level of sound is known as a "high-pitched" or a "high-frequency" sound, a low-level sound is called a "low-pitched" or a "low-frequency" sound. The frequency of a sound depends on the speed of vibration of the sound source. When the sound source vibrates quickly, the pitch level of the sound increases, and so does its pitch. On the other hand, when the sound source vibrates slowly, its frequency decreases, and so does its pitch. Figure 3 shows two sound waves with the same amplitude but different frequency.

Figure 1. Parakeet

It has a high-pitch chirp

Its chirp has a high frequency

Its sound has a shorter wavelength

Its pitch level of sound is high

Figure 2. Eagle

It makes a deep sound

Its sound has a low frequency

Its sound has a longer wavelength

Its pitch level of sound is low

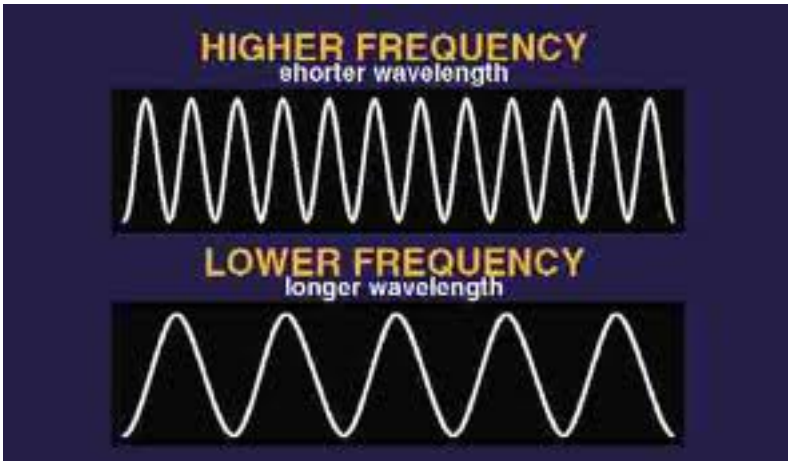


Figure 3. Two sound waves with the same amplitude but different frequency

In everyday life, sound instruments such as hearing aids and megaphones are used to increase the intensity of sound.

Part 4

When students perceive the difference between misconceptions and scientifically true explanations, they are asked to express their own opinions. The aim in this part is to measure how much awareness has been raised among students and see if they still have some question marks in their minds or not. The ultimate goal here is to observe if the students have accepted the new knowledge.

Did you change your mind after reading the text? If you did, please express your views once again considering the text now, and give an example. …….

……

Part 5

In this part, the purpose is to understand whether or not the students have grasped the text well. The teacher draws a conclusion on the basis of the text.

Now, let's answer the following questions:

I. What is the "intensity of sound?"

……

……

II. What is the "pitch level of sound?"

……..

……

III. What type of relation is there between the "frequency of sound" and the "pitch level of sound?"

……

……

IV. Which characteristic of sound explains the

fact that dogs can hear the sounds that human beings cannot? Can you give other examples?

……..

……..

V. Which characteristic of sound can be changed by using a remote control device?

……..

……..

Below can be found another conceptual change text designed about sound. This one can be offered to students right after the text above is used in class. These two conceptual change texts can be used in two teaching hours (45 minutes each).

Now, let's read the other text!!

Part 1

Speed of Sound

Mert joined a high school quiz show. He has to answer the last question right to win first place. Up to the last question, he has performed excellently. However, when the last question is asked, Mert hesitates. The question asked is whether sound travels the fastest through liquids, solids or the atmosphere. What do you think Mert should say?

Please justify your answer. ……

Part 2

The most common wrong answer to that question is that "Because sound does not meet with

an obstacle when traveling through the atmosphere, it moves fastest in the air." Okay, what is your answer? Now, let's read the following text.

Part 3

Let's see if your answer is correct

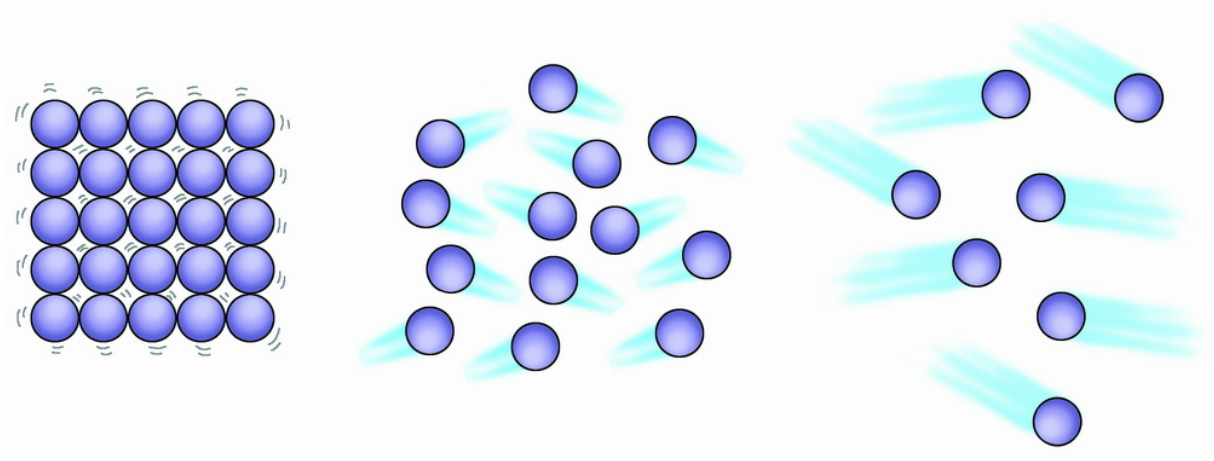
Sound waves are known as mechanical waves. To transfer their energy, mechanical waves need atmospheric molecules. That is why they cannot travel in space. Sound waves are made up of objects' vibration, and in suitable environments like air, water, etc., they travel from one point to another by squeezing in and spreading out.

Due to the fact that solids are composed of molecules held together, sound travels through solids much faster.

As molecules in liquids are farther away from each other in comparison to solids, sound travels more slowly in liquids. In gases, on the other hand, molecules are the farthest from each other. Therefore, the speed of travel of sound in gases when compared to liquids is even slower (Figure 4).

To exemplify, sound travels much faster in a steel pot compared to how it travels through water in a bucket. Furthermore, it travels much faster in water in a bucket than it does in the atmosphere.

Sound is created in the atmosphere as air molecules crash into other air molecules in the atmosphere. Some of the energy that creates sound transforms into heat energy when air molecules crash into other air molecules. As a result, as sound moves away from its source, its intensity decreases.



solid liquid gas

Figure 4.

Part 4

Did you change your mind after reading the text? If you did, explain your views again in the light of the text and give relevant examples.

……

…..……..……

Part 5

Now, let's answer the questions below:

I. How do sound waves travel?

…….

…….

I. Does sound travel at the same speed in solids, liquids and gases? Why? Why not?

……..

……..

III. Does sound intensity change as it moves away from its source? Why? Why not?

…….

…….

V. Can planting trees in front of our houses contribute to sound insulation? Explain your views please.

……..

……...

√. Is it possible to hear the sound of a ticking clock in an airtight jar? Why? Why not?

……

…….

Discussion and conclusion

In this study, the researchers presented two conceptual change texts that can be used to overcome some common misconceptions regarding "sound intensity" and "how fast sound travels." The texts written by the researchers were designed in a format that can be used both in middle school and in physics courses for high school seniors. These materials were tested using two small groups of students, and included qualitative data based on only the students' statements. The first group was comprised of eighth-grade students (n=12). In this group, the subject of "sound" had been covered in the lower levels of the course to a limited extent but the researchers began the application before reviewing the subject. A comprehensive unit about "sound" is included in the eighth-grade syllabus. The other group consisted of ninth-grade students (n=15). This group had already covered "sound" in eighth grade. However, time had passed and it was assumed that students may have forgotten the key concepts, or misconceptualized some of the terms. One of the reasons why the pilot study was tested on two different groups was to see if conceptual change texts are more effective in diagnosing misconceptions or in overcoming them. Another reason was to see if the two groups held the same or different misconceptions.

When the students' worksheets were studied carefully, it was observed that both elementary school and secondary school pupils had similar misconceptions. For instance, 24 students stated that sound travels much faster in the atmosphere than anywhere else. One of the students made the comment, "If we scream inside water we may not be heard well; yet if we scream in open air, then we can be heard much better." It was observed that most students thought that "sound intensity" and "sound pitch level" are the same concepts. Although a few students wrote down the correct answer, "sound intensity," they were not able to exactly describe what sound intensity is. This proved that students had a problem with fully understanding the concepts.

In the pilot implementation, the worksheets distributed to the students were given out not altogether but in parts. The reason for this was to prevent students from producing offhand responses by only looking at the text without understanding the concept. The worksheets have questions in the last section. The answers to some of these questions are in the text but some are not. The objective here was to see if the students had completely understood the concepts and could transfer this knowledge to other situations. An attempt was thus made to reach a definitive judgement about whether the students had been able to overcome their misconceptions. At this point, it might be recommended to implementers that working with parts of the worksheets instead of distributing them all at once would be a more effective method. The attachments show the worksheets being given to a 9th grade student (in the student's native language of Turkish with English translations, see Appendices A and B).

Finally, the researchers came to the conclusion that these texts, which were designed in accordance with the researchers' observations throughout the pilot study and derived from the data collected from the students' worksheets, could be used to identify misconceptions about sound in both groups, and they were useful in overcoming fallacies.

Limitations and Recommendations

The main limitations of the study were that the sample was very small and no quantitative comparison had been made between the group in which students used the conceptual change texts and the group in which they did not. For this reason, this study can only be regarded as advisory. To measure the effects of these texts

on students' success, further comparative research must be carried out with larger samples. The following recommendations can be made with regard to the teaching materials: researchers should comply with the four conditions stated by Posner et al. (1982) in order to make these conceptual change texts effective teaching tools. In addition, considering that there may be some students in class who have difficulty understanding what they read, the use of the material should definitely accompany classroom discussions.

References

Altun, S., Turgut, Ü., & Büyükkasap, E. (2007). *The effect of conceptual change texts on correcting misconceptions of university students about the topic of optics and on their attitudes*, 16th National Educational Sciences Congress, Gaziosmanpaşa University, Faculty of Education, Tokat, 5–7 September 2007.

Arnheim, R. (1997). *Visual Thinking*, Berkeley: University of California Press.

Başer, M. (2006). Effects of conceptual change and traditional confirmatory simulations on pre-service teachers' understanding of direct current circuits. *Journal of Science Education and Technology*, 15(5), 367-381.

Başer, M., & Geban, Ö. (2007). Effectiveness of conceptual change instruction on understanding of heat and temperature concepts, *Research in Science and Technological Education*, 25(1), 115-133.

Chambers, S. K. & Andre, T. (1997). Gender, prior knowledge, interest and experience in electricity and conceptual change text manipulations in learning about direct current. *Journal of Research in Science Teaching*, 34 (2), 107–123.

Dilber, R. (2006). *A study of the impact of using analogies and conceptual change texts to overcome misconceptions and their effect on student achievement*, Unpublished Doctorate Thesis. Atatürk University, Science Institute, Erzurum.

Dilber, R., Karaman, I., & Duzgun, B. (2009). High school students' understanding of projectile motion concepts. *Educational Research and Evaluation*, 15(3), 203-222.

Guzzetti, B. J., Williams, W. O., Skeels, S. A., & Wu, S. M. (1997). Influence of text structure on learning counterintuitive physics concepts. *Journal of Research in Science Teaching*, 34(7), 701-719.

Hırça, N. (2008). *A review of the effect of material developed related to "work-power-energy" based on the 5E Model on conceptual change*. Unpublished Doctorate Thesis, Atatürk University, Erzurum.

Hrepic, Z. (1998). Students' conceptions in understanding sound. *Bachelor's thesis, University of Split*, Croatia.

Hrepic. Z. (2004). Development of real-time assessment of students' mental models of sound propagation, Doctorate Thesis, *University of Split*, Split, Croatia.

Linder, C.J. (1992). Understanding sound: So what is the problem? *Physics Education*, 27(5), 258 - 264.

Merino, M.J. (1998). Complexity of pitch and timbre concepts, *Physics Education*, 33(2), 1105-109.

Pınarbaşı, T., & Canpolat, N. (2002). An approach to conceptual change in science education-II: Conceptual change texts, *Kastamonu Journal of Education*, 10, 281 -286.

Posner, G. J., Strike, K. A., Hewson, P.W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: toward a theory of conceptual change. *Science Education*, 66(2), 211-227.

She, H. C. (2003). DSLM instructional approach to conceptual change involving thermal expansion, *Research in Science and Technological Education*, 21(1), 43-54.

Smith, E. L., Blakeslee, T. D. & Anderson, C. W. (1993). Teaching strategies associated with conceptual change learning in science, *Journal of Research in Science Teaching*, 30 (2), 111–126.

Viennot, L.(2001) Reasoning in physics: The part of common sense. *Kluwer Academic Publishers, London.*

Wang, T. & Andre, T. (1991). Conceptual change text versus traditional text application questions versus no questions in learning about electricity, *Contemporary Educational Psychology*, (16), 103–116.

Wittmann, M.C., Steinberg, R.N., & Redish, E.F. (2003). Understanding and affecting student reasoning about sound waves. *International Journal of Science Education*, 25(8), 991-1013.

Appendix

A (Student responses for text 1)

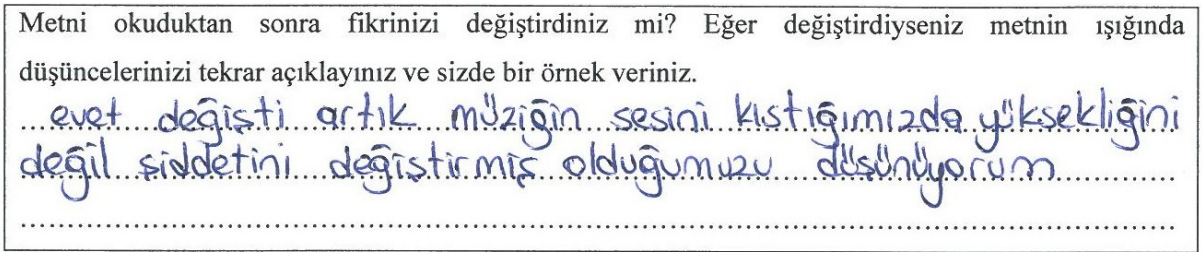
Part 1


Lütfen yanıtınızı gerekçesi ile yazınız.
Yüksek tonlu ses deriz. Bu özellik sesin tonunun değişimiyle ilgilidir.

Please answer the question by explaining your reasons.

"We would call this a high-pitched sound. This characteristic has to do with the change in the pitch level of the sound."

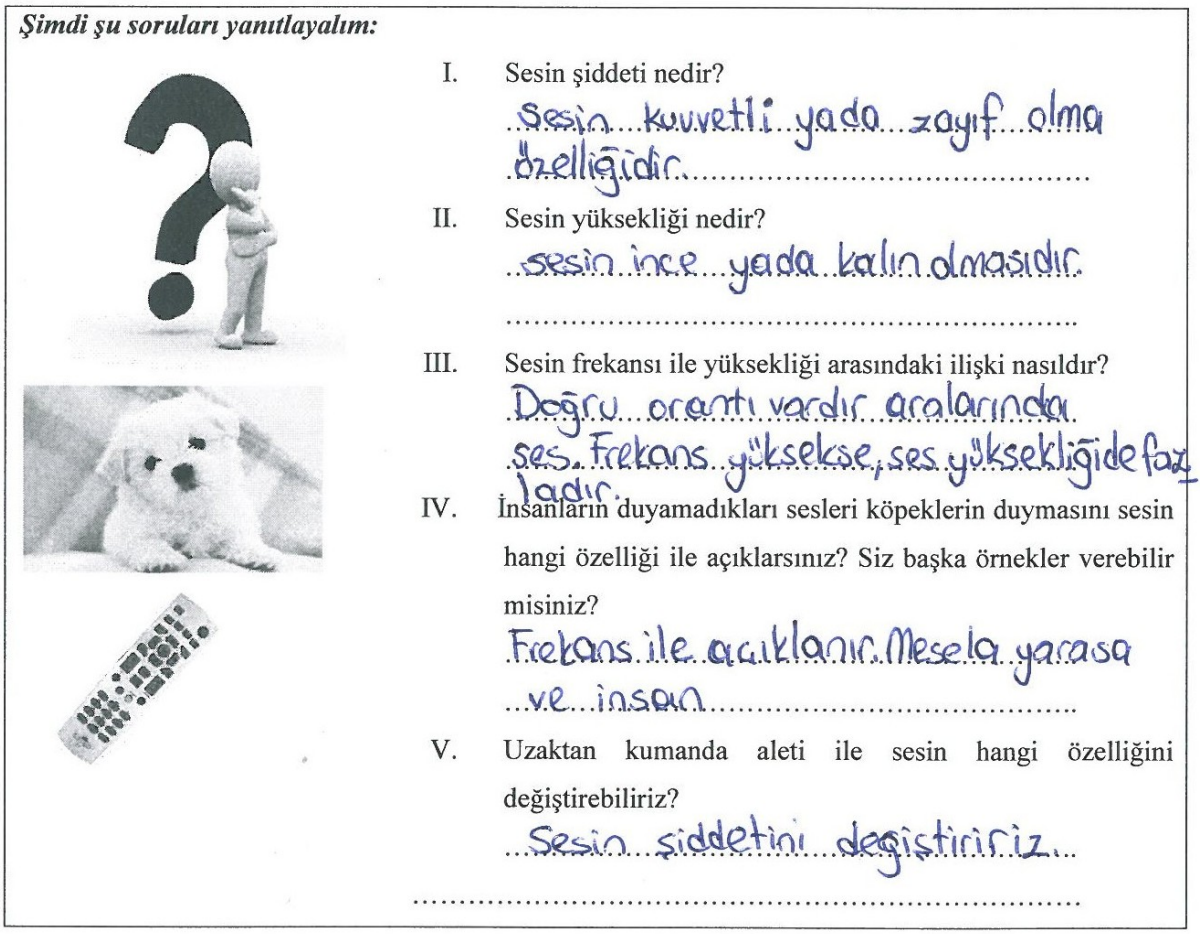
Part 4


Metni okuduktan sonra fikrinizi değiştirdiniz mi? Eğer değiştirdiyseniz metnin ışığında düşüncelerinizi tekrar açıklayınız ve sizde bir örnek veriniz.
evet değişti artık müziğin sesini kıstığımızda yüksekliğini değil şiddetini değiştirmiş olduğunuzu düşünüyorum

Did you change your mind after reading the text? If you did, please express your views once again considering the text now, and give an example.

"Yes, it changed it. I now believe that when we turn the music down, we're changing not the pitch level, but the intensity."

Part 5



Şimdi şu soruları yanıtlayalım:

I. Sesin şiddeti nedir?

Sesin kuvvetli yada zayıf olma özelliğidir.

II. Sesin yüksekliği nedir?

sesin ince yada kalın olmasıdır.

III. Sesin frekansı ile yüksekliği arasındaki ilişki nasıldır?

Doğru orantı vardır aralarında. ses. Frekans yüksekse, ses yüksekliğide fazladır.

IV. İnsanların duyamadıkları sesleri köpeklerin duymasını sesin hangi özelliği ile açıklarsınız? Siz başka örnekler verebilir misiniz?

Frekans ile açıklanır. Mesela yarasa ve insan

V. Uzaktan kumanda aleti ile sesin hangi özelliğini değiştirebiliriz?

Sesin şiddetini değiştiririz.

Now, let's answer the following questions:

I. What is the "intensity of sound?

I. "It's the characteristic of the sound's being loud or soft…"

II. What is the "pitch level of sound?"

II. "It's the highness or lowness of the sound."

III. What type of relation is there between the "frequency of sound" and the "pitch level of sound?

III. "There's a direct relationship. If the frequency of the sound is high, the pitch of the sound is high too."

IV. What characteristic of sound explains the fact that dogs can hear the sounds that

human beings cannot? Can you give other examples?

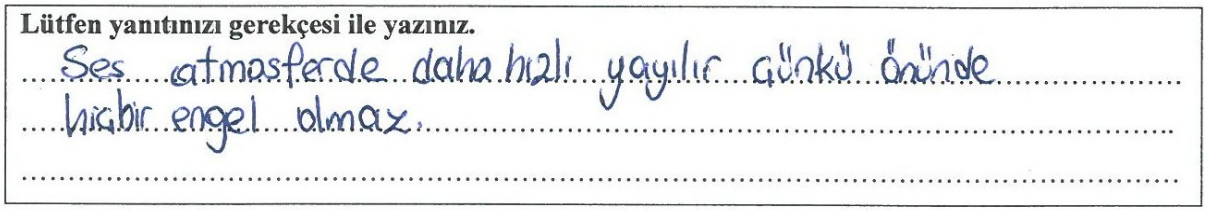
IV. "It can be explained by frequency. For instance, bats and human beings."

V. Which characteristic of sound can be changed by using a remote control device?

V. "We can change the intensity of the sound."

B (student responses for text 2)

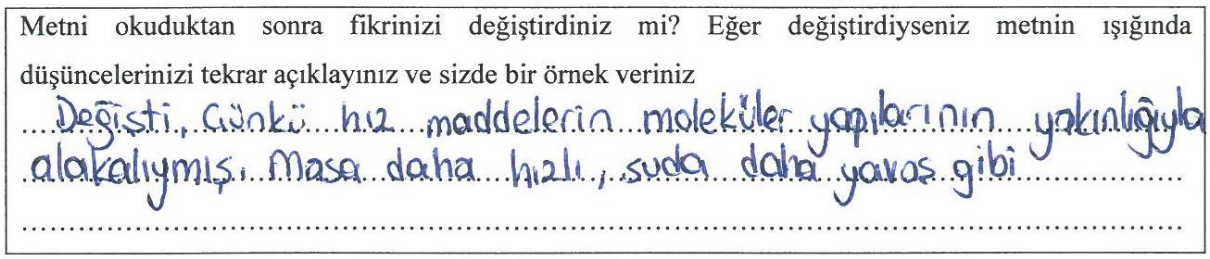
Part 1


Lütfen yanıtınızı gerekçesi ile yazınız.
Ses atmosferde daha hızlı yayılır çünkü önünde hiçbir engel olmaz.

Please answer the question by explaining your reasons.

"Sound travels faster in the atmosphere. Because there's nothing in its way."

Part 4

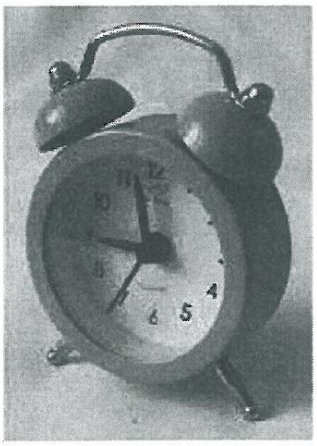

Metni okuduktan sonra fikrinizi değiştirdiniz mi? Eğer değiştirdiyseniz metnin ışığında düşüncelerinizi tekrar açıklayınız ve sizde bir örnek veriniz
Değişti, çünkü hız maddelerin moleküler yapılarının yakınlığıyla alakalıymış. Masa daha hızlı, suda daha yavaş gibi

Did you change your mind after reading the text? If you did, please express your views once again considering the text now, and give an example.

"It changed because I learned that speed is related to the closeness of molecules. They are faster in a table and slower in water, for example."

Part 5

Şimdi şu soruları yanıtlayalım:



I. Ses dalgaları nasıl ilerlerler?
Sıkışma ve genleşme ile ilerler.

II. Sesin katı, sıvı ve gaz ortamlarında yayılma hızı aynı mıdır? Neden?
Aynı değildir. Moleküller arası uzaklıklar farklıdır.

III. Ses kaynağından uzaklaştıkça sesin şiddetinde bir değişme olur mu? Neden?
Değişme olur. Azalır. Uzaklaş_tığından dolayı.

IV. Evlerimizin önünü ağaçlandırmamızın ses yalıtımıyla bir ilişkisinin olduğu söylenebilir mi? Açıklayınız.
Ağaçlar engel oluşturacağından şiddeti azalır.

V. Havası boşaltılmış bir cam kavanoz içindeki saatin sesini duyabilir miyiz? Neden?
Hayır duyamayız. Ses havasız ortamda yayılmaz.

Now, let's answer the following questions:

I. How do sound waves travel?

I. "They move by squeezing and expanding."

II. Does sound travel at the same speed in solids, liquids and gases? Why? Why not?

II. "They're not the same. Distances between molecules are different."

III. Does sound intensity change as it moves away from its source? Why? Why not?

III. "There would be a change. It would be less because it moves further away."

IV. Can planting trees in front of our houses contribute to sound insulation? Explain

your views please.

IV. “It would lessen because of the obstruction of the trees.”

V. Is it possible to hear the sound of a ticking clock in an airtight jar? Why? Why not?

V. “No, we can’t hear it. Sound doesn’t travel in an airless medium.”