

# Music and Work



Some people think that music helps them to concentrate.  
Others say that it is a distraction when they are trying to work.

How could you test what effect listening to music has on performance?  
Design an experiment. Answer the following questions.

- 1 What hypothesis will be tested?
- 2 Who will take part?
- 3 Where will the experiment take place?
- 4 What equipment will be needed?
- 5 What will be the method? (i.e. Exactly what will happen during the experiment?)
- 6 What data will be collected?
- 7 How will results be recorded?
- 8 What methods will be used to analyse the results?
- 9 How will the results be used to test the truth of the hypothesis?
- 10 What problems may arise?



**Test A** Answer as many questions as you can (without using a calculator).

1	$357 + 194$	
2	$412 - 238$	
3	$389 \times 7$	
4	$837 \div 9$	
5	Write 9463 to 2 significant figures.	
6	Find 14% of £65.	
7	Find the cost of 7 pens if they cost £1.59 each.	
8	Simplify the ratio 1080:960.	
9	Find $\frac{3}{8}$ of £12.80	
10	13 out of a class of 25 are male. What percentage is this?	
11	I have $1\frac{1}{4}$ hours free on my video tape. How much time will remain free if I tape a programme lasting 35 minutes?	
12	The area of a square is $81 \text{ cm}^2$ . What is its perimeter?	
13	I order four pizzas costing £1.95 each. How much change will I get from £10?	
14	How long would it take to travel 405 miles at a steady speed of 60 mph?	
15	How many days are there from March 14 <sup>th</sup> to May 5 <sup>th</sup> inclusive?	



16 The temperature was $9^{\circ}\text{C}$ before it fell by $17^{\circ}$ . What was the final temperature?	
17 $1.3 \times 0.03$	
18 $0.4 \div 0.08$	
19 I set off at 11.40 am. The journey takes $3\frac{3}{4}$ hours. What time will I arrive?	
20 1 kg is approximately 2.2 pounds. Convert 4.6 kg to pounds.	
21 Add together the odd numbers between 12 and 20.	
22 VAT is $17\frac{1}{2}\%$ . Find the VAT on an article costing £84.	
23 Tickets cost £3.65 for adults and £1.45 for children. How much will it cost for a family of two adults and three children?	
24 A roll of ribbon is 4 m long. How many pieces of length 27 cm can be cut from the roll and how much is left?	
25 There were 24 694 men, 9 876 women and 12 375 children at the match. How many were there altogether?	
26 A triangle has altogether $180^{\circ}$ . If two of its angles are $47^{\circ}$ and $59^{\circ}$ what is the third angle?	
27 Divide £2.73 in the ratio 5:8	
28 The diameter of the earth is 12 756 km and that of Mercury is 4 878 km. What is the difference between them?	
29 The total surface area of a cube is $384\text{ cm}^2$ . What is the length of its sides?	
30 What fraction is 36 of 240?	



**Test B** Answer as many questions as you can (without using a calculator).

1	$439 + 292$	
2	$321 - 146$	
3	$276 \times 8$	
4	$532 \div 7$	
5	Write 8359 to 2 significant figures.	
6	Find 16% of £45.	
7	Find the cost of 9 pens if they cost £1.48 each.	
8	Simplify the ratio 840:1440.	
9	Find $\frac{5}{8}$ of £11.20	
10	14 out of a class of 25 are female. What percentage is this?	
11	I have $1\frac{1}{2}$ hours free on my video tape. How much time will remain free if I tape a programme lasting 55 minutes?	
12	The area of a square is $64 \text{ cm}^2$ . What is its perimeter?	
13	I order three pizzas costing £1.80 each. How much change will I get from £10?	
14	How long would it take to travel 310 miles at a steady speed of 50 mph?	
15	How many days are there from August 17 <sup>th</sup> to October 7 <sup>th</sup> inclusive?	



16 The temperature was $8^{\circ}\text{C}$ before it fell by $13^{\circ}$ . What was the final temperature?	
17 $1.7 \times 0.02$	
18 $0.6 \div 0.05$	
19 I set off at 11.35 am. The journey takes $3\frac{1}{2}$ hours. What time will I arrive?	
20 1 kg is approximately 2.2 pounds. Convert 7.4 kg to pounds.	
21 Add together the even numbers between 11 and 19.	
22 VAT is $17\frac{1}{2}\%$ . Find the VAT on an article costing £46.	
23 Tickets cost £3.85 for adults and £1.35 for children. How much will it cost for a family of three adults and two children?	
24 A roll of ribbon is 3 m long. How many pieces of length 18 cm can be cut from the roll and how much is left?	
25 There were 19 735 men, 8967 women and 13 984 children at the match. How many were there altogether?	
26 A triangle has altogether $180^{\circ}$ . If two of its angles are $68^{\circ}$ and $49^{\circ}$ what is the third angle?	
27 Divide £3.08 in the ratio 9:5	
28 The diameter of the earth is 12 756 km and that of Mars is 6786 km. What is the difference between them?	
29 The total surface area of a cube is $486\text{ cm}^2$ . What is the length of its sides?	
30 What fraction is 24 of 180?	





<b>Teacher Notes</b>
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**Unit** Advanced Level, Using and applying statistics

**Skills used in this activity:**

- designing an experiment to test a hypothesis
- analysing data from an experiment (using statistical diagrams and measures of location and spread)
- interpreting results

**Preparation**

Check that the questions in Tests A and B are appropriate for your students. You may wish to extend the tests or use questions that are more relevant to the students' other areas of study or interests. It is important that the two tests have the same number of questions and are of similar difficulty. The items needed for each session are listed below.

**1<sup>st</sup> session:**

- a copy of the worksheet (page 1) for each student

**2<sup>nd</sup> session:**

- copies of Test A and Test B for each student
- enough equipment for playing music through headphones for half of the students
- Test Answers and Mark Sheet

**3<sup>rd</sup> session:**

- graph paper

**Notes on the Activity**

**1<sup>st</sup> session – designing the experiment**

After the idea of using an experiment to test a theory has been introduced, students can work in groups (or individually) to try to write a hypothesis and design an experiment to investigate the effect listening to music has on performance. The worksheet has been written in general terms so that students may define 'performance' in a way that is relevant to them.

Share ideas and decide on an appropriate hypothesis and experiment. (Depending on the ideas offered, this may or may not be similar to the experiment suggested for the 2<sup>nd</sup> session.)

Points to be discussed include

- writing a clear and unambiguous hypothesis
- populations, samples, randomisation, bias, dependent and independent variables
- ethical issues such as the informed consent of people taking part in experiments
- extraneous variables that might affect the results (both subject related eg mathematical ability and situational eg suitability of room and distractions)
- experimental design (Include the repeated measures design suggested for the 2<sup>nd</sup> session in which each student takes part in the experiment twice, both with and without music. Discuss order effects such as practice and tiredness and how these can be reduced by counterbalancing.)
- generalisation of the results



At the end of the discussion outline the experiment to be carried out during the 2<sup>nd</sup> session. If necessary arrange for students to bring in enough equipment to play music to half of the students in the group. If this is not possible the experiment will need to be redesigned.

### **2<sup>nd</sup> session**    *Carrying out the experiment*

- Divide the students at random into two groups (1 and 2) and give out Test A.
- During this test Group 1 will be allowed to listen to music. Group 2 will not. If this is done by using headphones as suggested, you will need to allow a few minutes before the test begins for Group 1 to test the equipment. It is important to ensure that the sound level is low enough so that it cannot be heard by students in Group 2.
- Allow 10 or 15 minutes for students to do as many questions as they can from Test A.
- At the end of this time, ask students to write on the test paper whether or not they had listened to music during the test.
- Ask students in Group 1 to give the equipment to those in Group 2.
- Give out Test B. During Test B Group 2 will be allowed to listen to music. Group 1 will not. Carry out the testing in exactly the same way as before (again allowing 10 or 15 minutes).
- After the tests are completed, go through the answers so the students can mark their work. One mark should be given for each correct answer and the marks added together for each test paper.
- Collect the final results and draw up a table of the raw data. A possible layout is given on page 6. The table could be photocopied and each student given a copy for analysis in the 3<sup>rd</sup> session.

### **3<sup>rd</sup> session**    *Analysing the Results*

The marks achieved by students who listened to music can be compared to the marks achieved by those who did not listen to music using:

- statistical diagrams such as histograms, frequency polygons, box and whisker plots or cumulative frequency graphs
- measures of location such as mean, median and mode
- measures of spread such as range, standard deviation and interquartile range

If students are already familiar with these techniques they could be asked to analyse the results independently and write a report. If not, the data can be used for teaching the methods involved.

Students should be asked to come to some conclusion regarding the truth of the hypothesis. Discuss problems in applying the findings to other groups of people.

### **Alternatives/ Extensions**

This activity could be done later in the course rather than as a unit starter. Students who have studied hypothesis tests in other areas of their study programme could apply a significance test ( $t$  test, sign test or Wilcoxon signed rank test) to the data.



**Answers to Tests****Test A**

1	551	2	174	3	2723	4	93	5	9500
6	£9.10	7	£11.13	8	9:8	9	£4.80	10	52%
11	40 mins	12	36 cm	13	£2.20	14	$6\frac{3}{4}$ hours	15	53 days
16	$-8^{\circ}\text{C}$	17	0.039	18	5	19	3.25 pm	20	10.12 lb
21	64	22	£14.70	23	£11.65	24	14, 22 cm	25	46 945
26	$74^{\circ}$	27	£1.05, £1.68	28	7878	29	8 cm	30	$\frac{3}{20}$

**Test B**

1	731	2	175	3	2208	4	76	5	8400
6	£7.20	7	£13.32	8	7:12	9	£7	10	56%
11	35 mins	12	48 cm	13	£4.60	14	$6\frac{1}{5}$ hours	15	52 days
16	$-5^{\circ}\text{C}$	17	0.034	18	12	19	3.05 pm	20	16.28 lb
21	60	22	£8.05	23	£14.25	24	16, 12 cm	25	42 686
26	$63^{\circ}$	27	£1.98, £1.10	28	5970	29	9 cm	30	$\frac{2}{15}$

