

Biology Project

Investigate and compare the quantitative effects of changing,

- (i) the duration of light physical exercise and
- (ii) the time elapsed since the exercise stopped

on the pulse rate of a person.



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Background

Exercise increases the heart beat and pulse to get rid of **carbon dioxide** and increase **oxygen** in the muscle cells for respiration.

The **pulse** can be measured by phone app, heart monitor or manually.

The average pulse is **72 bpm** (beats per minute). At rest, the pulse has a '**resting rate**' usually slightly lower than this.

As we **exercise** the pulse **increases**.



Longer duration exercise should push the pulse up higher. We will investigate if it continues to rise during a longer duration of exercise or if it stops going up after a certain amount of time.

Once the exercise stops we find that the pulse will slow and return to its resting rate and often **lower** than it was at the start. This is because the body has lots of oxygen and little carbon dioxide after the exercise.



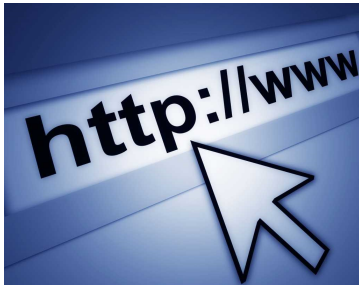
Part 1 (Introduction)

(i) Statement or problem to be investigated - What you are going to do **in your own words**

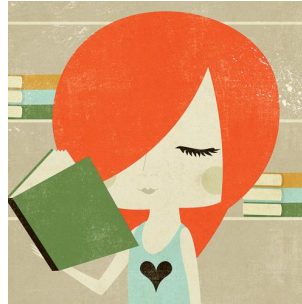
(ii) Background research undertaken - You will have to look up a few websites and books to find information for your investigation. You may even have to ask your teacher or someone at home for information. This is your background research you will need to give **at least 2 pieces** of background research and make sure for these that you mention where you got the piece of information and what you used it for.

e.g. <https://www.youtube.com/watch?v=dQqApCGd5Ss>

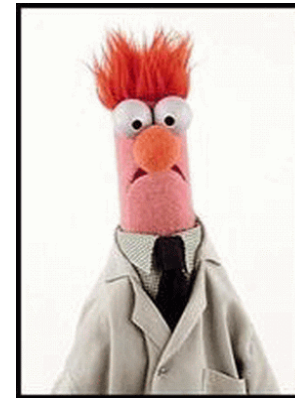
Internet
(Give full link!)



Books
(Author and Publisher
Page and Details)



Teacher



Part 2 (Preparation and Planning)

(i) Variables

1. Independent Variables

What I will change? **Duration (Length) of exercise**

2. Dependent Variable

What I measure? Pulse rate **before, during and after** exercise

3. Controls

What I will keep the same?

- **The exercise type and intensity**
- **The method of measuring the pulse**
- **How often pulse is measured and for how long**

(ii) Equipment: List every piece of equipment you use.

e.g. Stopwatch, Phone app for measuring pulse* (or similar method), pen and paper for results, runners!

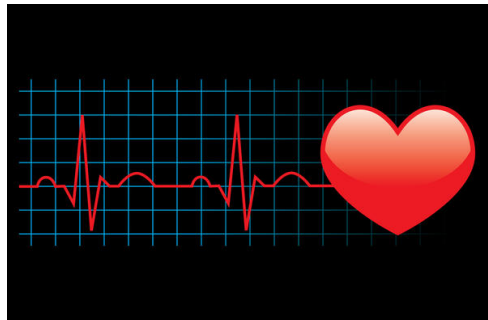
* = Instant heart rate by azumio



(iii) Tasks *This is the list of jobs (to-do list) that need to be done in order.*

e.g.

- We will take the subjects pulse before exercise (step-ups).
- The subject then exercises for a set time (30, 60, 90 or 120 seconds).
- The pulse is taken at the end of the exercise and for every 30 seconds afterwards until the pulse returns to the resting rate.
- The results are noted in a table, graphs are drawn and the results analysed.



Part 3 (Procedures, apparatus etc.)

(i) Safety - We ensure the area where exercise takes place is free from hazards that may cause an accident or fall.

(ii + iii) Procedure with diagram - Write it like a recipe.



1. The pulse will be measured with a iPhone App continuously during the experiment and rates recorded by another person in a pre-made table. Another person is responsible for measuring the time and announcing 30 second intervals.
2. We will take the subjects pulse before exercise while they are seated. (Resting Rate).
The person does step-ups on a box for 30 seconds. Pulse is noted at 30 seconds when the exercise stops. The pulse rate is noted every 30 seconds till it returns to normal.
3. We will take the subjects pulse again before exercise while seated.
The person does step-ups on a box for 60 seconds. Pulse is noted at 60 seconds when the exercise stops. The pulse rate is noted every 30 seconds till it returns to normal.
4. We will take the subjects pulse again before exercise while seated.
The person does step-ups on a box for 90 seconds. Pulse is noted at 90 seconds when the exercise stops. The pulse rate is noted every 30 seconds till it returns to normal.
5. We will take the subjects pulse again before exercise while seated.
The person does step-ups on a box for 120 seconds. Pulse is noted at 120 seconds when the exercise stops. The pulse rate is noted every 30 seconds till it returns to normal.
6. The table is filled in fully and graphs drawn to represent the data. More people can be tested if required.

(iv) Data and observations -

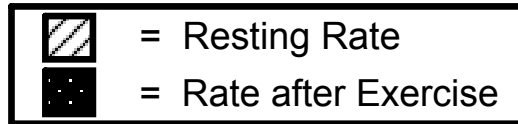
Record all the results from each experiment in a table like below.

Make a data table **before** you start your experiment so you can record your measurements as soon as you observe them.

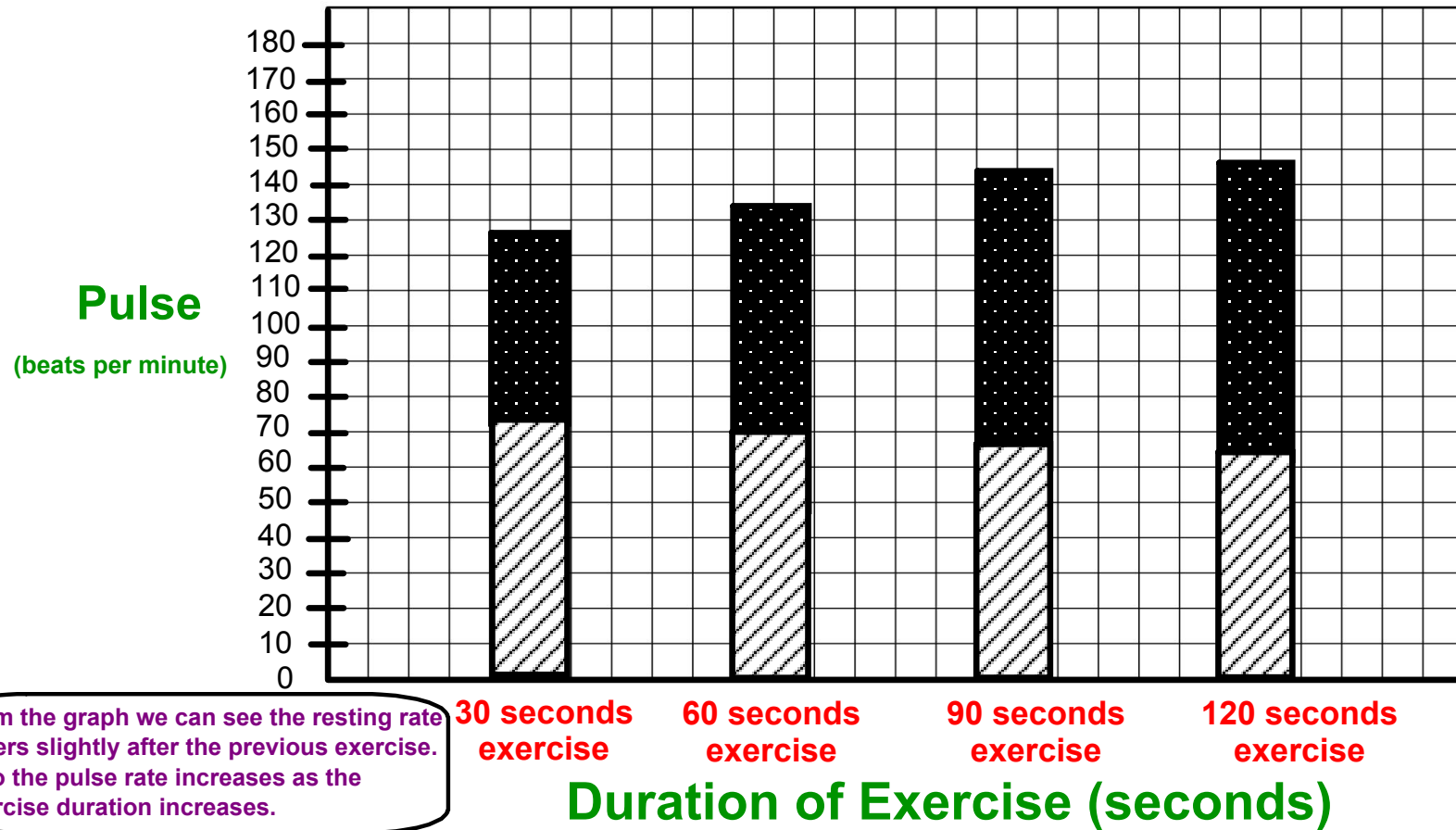
Give your tables and graphs a title.

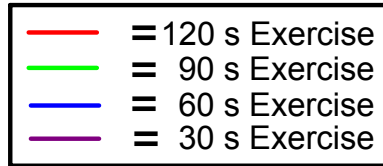
Table No. 1 - Pulse Rate for Duration and Recovery Times

	Resting Rate	Rate straight after exercise	30 Seconds after exercise	60 Seconds after exercise	120 Seconds after exercise	150 Seconds after exercise	Difference in b.p.m.
30 seconds exercise	72	128	100	73	66	-	56
60 seconds exercise	70	134	114	76	65	-	64
90 seconds exercise	68	146	117	79	71	66	78
120 seconds exercise	65	148	123	81	73	67	83



Graph No. 1 - Pulse Rate and Exercise Duration

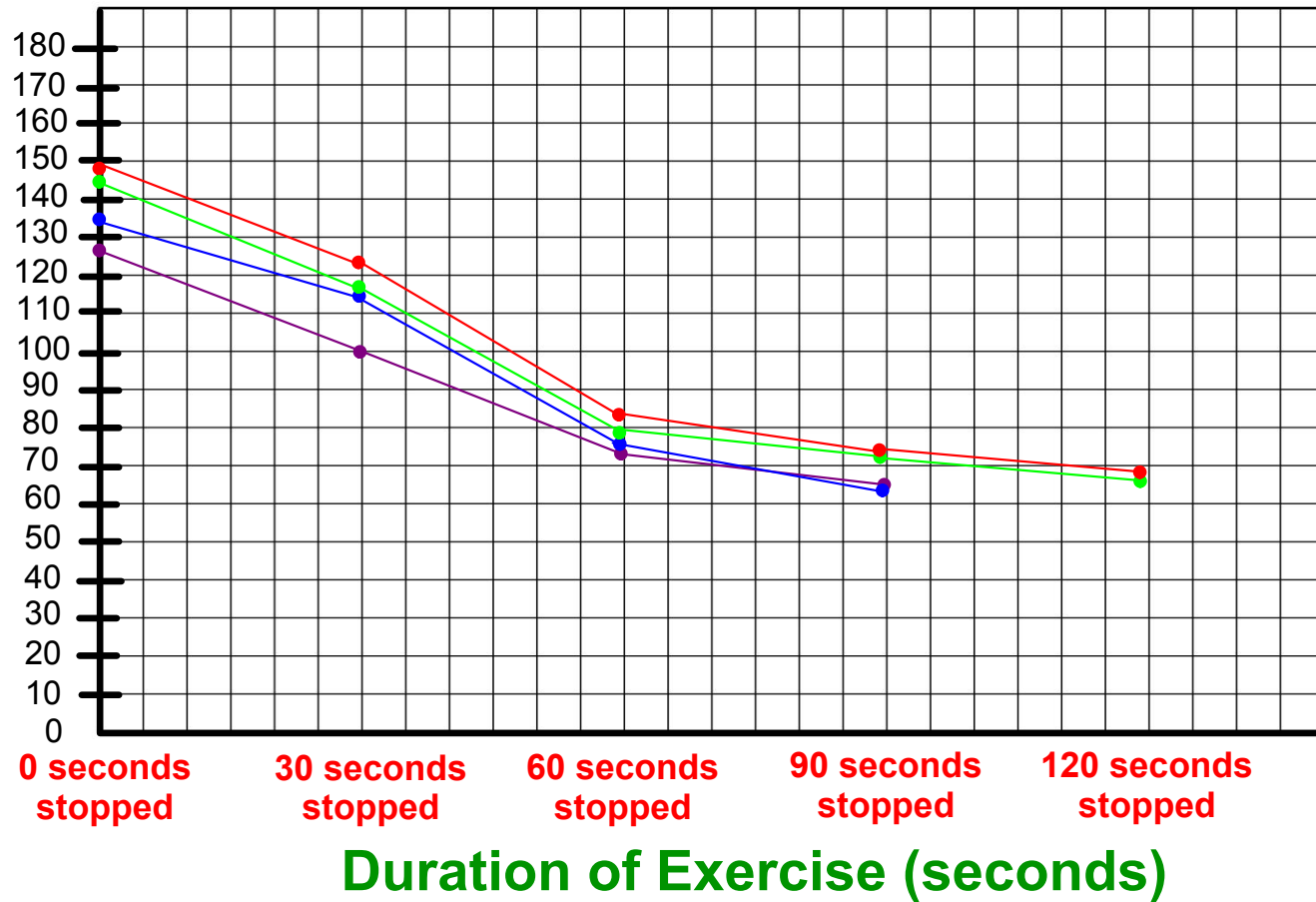




Graph No. 2 - Pulse rate and time elapsed since stopped.

Pulse Rate
(beats per minute)

From the graph we can see the pulse rate takes longer to return to the original resting rate as the exercise duration increases.



Analysis

Now, analyze your data, and see if increasing the duration effects the pulse rate or how long it takes for the rate to return to the original rate.

Questions to think about...

What happens to the heart rate when we exercise?

Does longer exercise keep increasing the pulse rate?

Does the rate drop immediately when exercise is stopped?

If the rate drops quickly back to normal does this mean you are more fit?

Does the pulse rate take longer to return to normal after a long period of exercise?

Can you think of any other questions?



Part 4 (Analysis)

(i) Calculations and Data Analysis -

Make sure you outline any calculations (e.g. finding averages)

We could take the resting rate away from the final highest rate in each exercise duration to get an idea of how much the rate is changing due to the length of time spent exercising.

e.g. After 120 seconds - 148 b.p.m. - 65 b.p.m. = 83 b.p.m. difference.

We could create a graph to show this?

(ii) Conclusion and Evaluation of result

Some useful sentence starters in this section are:

- I can see from my results that
- When I changed, changed by.....
- From the graph I can see that

Answer some of the following questions in your written report.

- Do your results answer the question you were asking at the start?
- Were the results as you expected?
- Is there a trend in your results or did anything unusual happen?
- If you got an unusual result why do you think this happened?



Conclusions

I can see from my results that as the duration of exercise increases so does the pulse rate. The longer the exercise, the higher the pulse rate. (see graph 1).

I also noticed that the resting pulse rate was slightly lower for each test as they proceeded, (see graph 1). Perhaps that is because the previous exercise saturates the blood with oxygen and reduces carbon dioxide levels so the heart does not have to work so hard.

The time taken after the exercise for the pulse rate to return to normal varied in each test. In the tests with shorter duration of exercise the pulse returned to normal quite quickly.



The longer the duration of exercise took longer for the rate to return to normal (see graph 2).

In conclusion the longer the exercise then the higher the pulse goes and the longer it takes to return to normal.

Part 5 (Comments)

(i) Refinements, extensions and sources of error

Were you expecting these results?

Possible errors?

Was there anything that might have affected your results?

Getting the finger position for pulse detection can be difficult for some
As a person does more and more exercise they get tired and may slow down

Could you develop your experiment further, how?

Test more people and in different forms of light exercise.

