

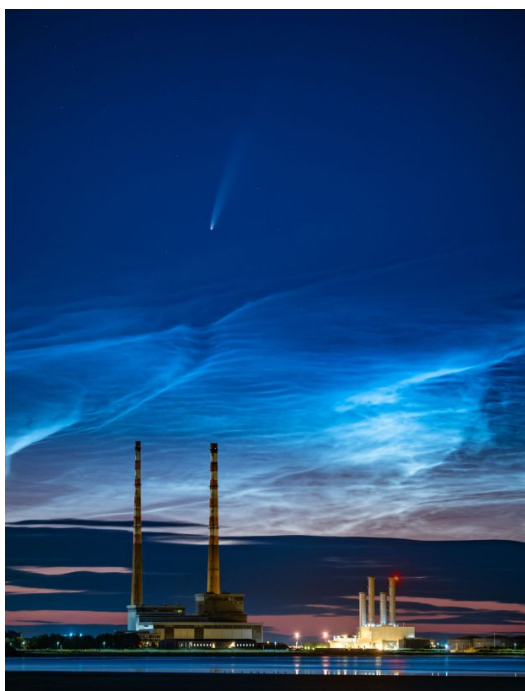
# 2<sup>nd</sup> Year Science, Christmas 2021

## Time allowed: Double class

**Mr. A. Goodison**

Student Name \_\_\_\_\_

Answer all questions in the spaces provided.



Good luck!

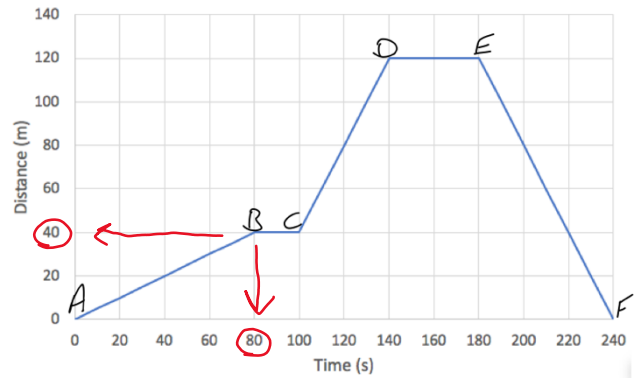
An image of comet Neowise captured over Dublin Bay taken by Antonio Martin Carrillo on the 12<sup>th</sup> of July 2020.

Question	Marks	Awarded
Total	78	
Grade descriptor		

Junior Cycle	
Percentage	Grade Descriptor
≥ 90 to 100	Distinction
≥ 75 and < 90	Higher Merit
≥ 55 and < 75	Merit
≥ 40 and < 55	Achieved
≥ 20 and < 40	Partially Achieved
≥ 0 and < 20	Not Graded (NG)

**Question 1 (7 marks)**

The graph represents the journey of a toy car.



(a) Name an instrument that could be used to measure the **distance** taken for the journey. (1)

Trundle wheel

(b) Calculate the average speed of the car as it travelled from point A to point B. Include the unit for your answer. (3)

$$\text{Speed} = \frac{\text{Dist}}{\text{Time}}$$

$$= \frac{40\text{m}}{80\text{s}} = 0.5\text{m/s}$$

Speed = ?  
 Distance = 40m  
 Time = 80s

(c) Describe the car's motion between points B and C of his journey. (1)

Stationary or stopped

(d) The car's speed as it travelled from point A to point B was less than its speed as it travelled from point C to point D. What evidence is there in the graph to support this? (1)

The slope is less steep between points A and D compared to C and D

(e) How much time (in seconds) was the car stopped in total? (1)

$$20 + 40 = 60\text{ s}$$

**Question 2 (5 marks)**

Elaine Thompson-Herah is a Jamaican sprinter who competes in the 100 metres and 200 metres. She is a five-time Olympic champion.

(a) In the Tokyo Olympics she won the **200 m** sprint in a time of **21.53 seconds**. What was her average speed? Include the unit. (3)

$$\text{Speed} = \frac{\text{Dist}}{\text{Time}}$$

$$= \frac{200\text{m}}{21.53}$$

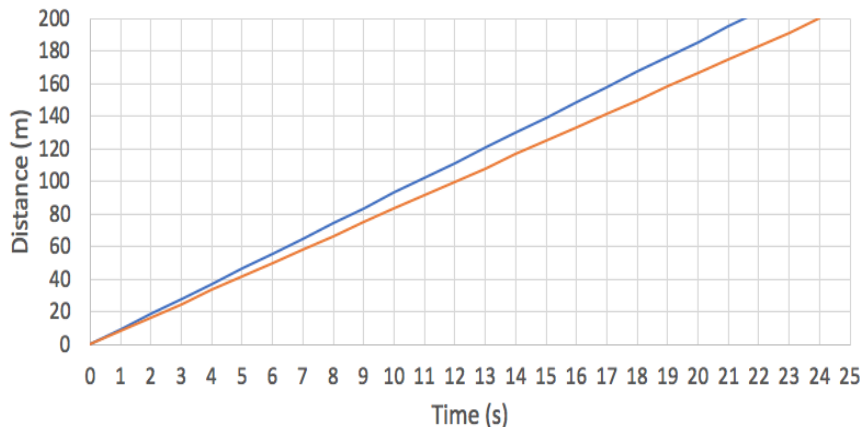
$$= 9.12\text{m/s}$$

Speed = ?  
 Dist = 200m  
 Time = 21.53s



(b) Below is a results table and graph of the 200m final.

The graph shows the average speed of Elaine Thompson-Herah and one other runner from the 200 m 2021 Olympic final. The results table gives the times of all runners in the race.



Results table

1		E. Thompson-Herah Jamaica	21.53
2		C. Mboma Namibia	21.81
3		G. Thomas United States	21.87
4		S. Fraser-Pryce Jamaica	21.94
5		M. Ta Lou Côte d'Ivoire	22.27
6		B. Masilingi Namibia	22.28
7		M. Kambundji Switzerland	22.30
8		S. Miller-Uibo Bahamas	24.00

Use the graph below and the results table to identify the name of other runner. Justify your answer. (2)

S Miller-Uibo as she was the only runner who finished in 24 seconds. We can see from the graph that she reached 200 m in 24 seconds

### Question 3 (3 marks)

Describe what happens in the respiratory system when a person breathes in. (3)

When a person inhales the diaphragm lowers. This decreases the pressure inside the lungs. The lungs expand and air is taken in. Air travels down the trachea into the lungs. Once the air has entered the lungs it goes into tiny air sacks called alveoli. This is where diffusion happens. Oxygen leaves the lungs and enters the blood while carbon dioxide leaves the blood and enters the lungs or alveoli.

(Any 3 one mark each)

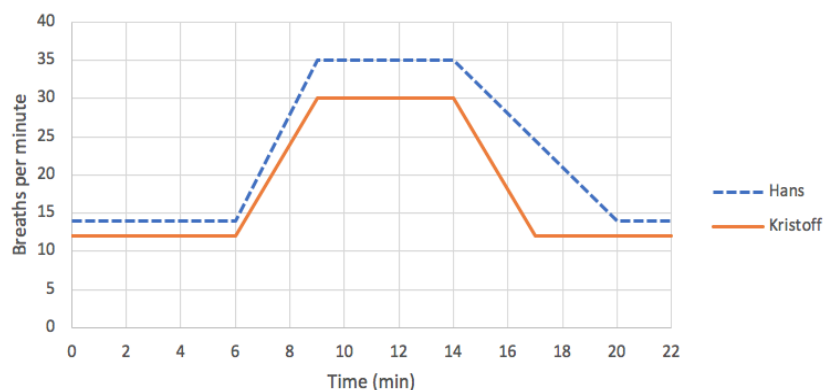
### Question 4 (5 marks)

The graph shows the breath rate for Hans and Kristoff during the same exercise.

(a) At what time did these two people start exercising? 6 minutes (1)

(b) Which person has the greatest breath rate during exercise?

Hans (1)



(c) After Hans stopped exercising, how many minutes did it take for his breath rate to return to normal? (1)

20 min - 14 min = 6 minutes

(d) Who is more likely to be the fitter person? Explain your answer. (2)

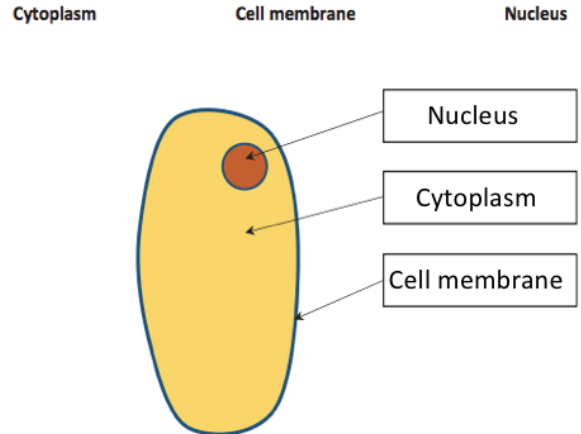
Kristoff as he has a lower breath rate and it took him less time for his breath rate to return to normal

**Question 5 (9 marks)**

(a) The diagram shows a cell. (a) Use the words provided to label the parts of the cell (3)

(b) Do you think the diagram is an animal or plant cell? Justify your answer. (2)

I think it is an animal cell because it has no cell wall, no chloroplast, no large vacuole (any one reason)



(c) Complete the table to give the function of the following cell structures. (4)

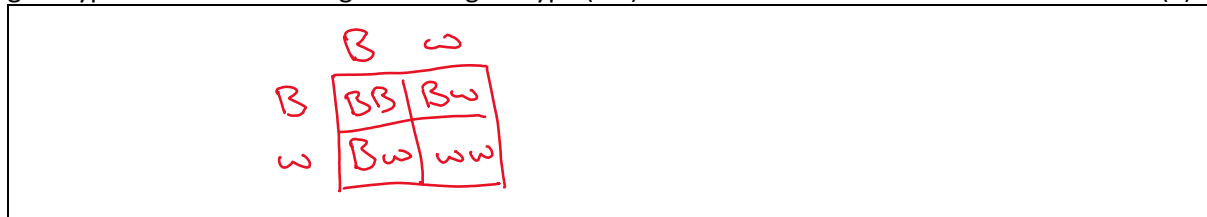
Cell structure	Function
Cell membrane	Controls what substances to enter and leave the cell
Nucleus	Contains DNA and controls the activities of the cell
Chloroplast	Responsible for photosynthesis
Mitochondria	Responsible for respiration OR releases energy from food

**Question 6 (6 marks)**

(a) Describe one difference between sexual and asexual reproduction. (2)

Sexual reproduction involves two parents while asexual involves only one. OR compares fertilisation, gametes, offspring being identical, mixing of DNA (any one)

(b) Dogs reproduce by sexual reproduction. The gene for a black dog (B) is dominant over the gene for a white dog (w). Complete a genetic cross (Punnett square) between a female dog with the genotype Bw and a male dog with the genotype (Bw). (1)



- (i) What is the chance that each puppy will carry the gene for white fur? 75% (1)
- (ii) What is the chance that each puppy will carry the gene for black fur? 75% (1)
- (iii) What is the chance that each puppy will be white? 25% (1)

**Question 7 (6 marks)**

Outline the theory of evolution by natural selection.

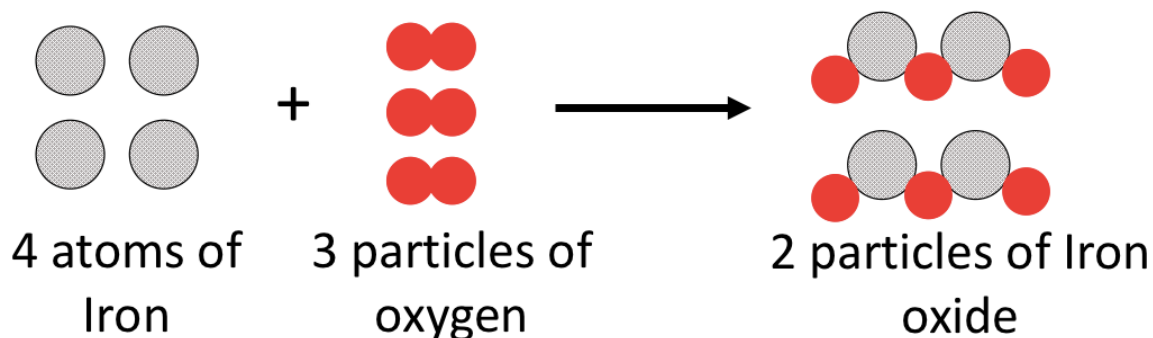
(6)

As species reproduce they produce many offspring, this is called overpopulation. Due to random genetic mutations in DNA there is variation between members of a species. Due to limited resources available competition takes place and only the fittest offspring, which is the best suited to their environment, will survive. This is called survival of the fittest. The surviving organism is more likely to reproduce, and pass on these beneficial-genes to the next generation. Over a long period of time a new species may form.

Any 3 (2 marks each)

**Question 8 (4 marks)**

Rusting is caused by iron (Fe) reacting with oxygen (O<sub>2</sub>) in the air to form iron oxide or rust (Fe<sub>2</sub>O<sub>3</sub>). The diagram below represents the reaction.



(a) Explain why this reaction is described as a chemical change (1)

Because a new type of particle is formed. OR Because a new substance is formed.

OR Because chemical bonds between atoms have been broken, rearranged and formed.

(b) How many oxygen atoms are in one particle of iron oxide? (1)

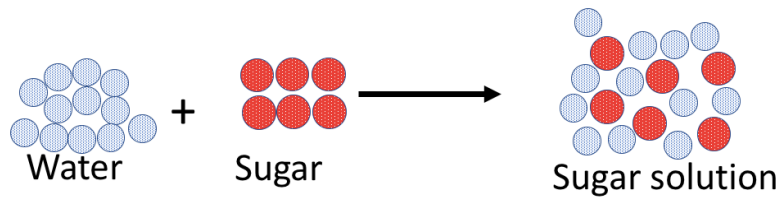
Three

(c) Mass is conserved (the same) during this reaction. From the diagram, what evidence is there for this? (2)

Because the total number of atoms before the chemical reaction is the same as the total number of atoms after the chemical change

**Question 9 (5 marks)**

The below image represents the arrangement of particles when sugar is dissolved in water.



(a) Is the sugar soluble in water. Use the particle diagram above to justify your answer. (2)

Yes, because the particles of sugar are now mingled in between the particles of water when the water and sugar combine the particles are jumbled/mingles together, no new atomic or chemical bonds are created.

(a) Explain why this change is described as a physical change (1)

Because a no new type of particle is formed. OR Because no new substance is formed.  
OR Because no chemical bonds between atoms have been broken, rearranged or formed.

(c) The sugar solution is an example of a mixture. Explain why it is described as a mixture (1)

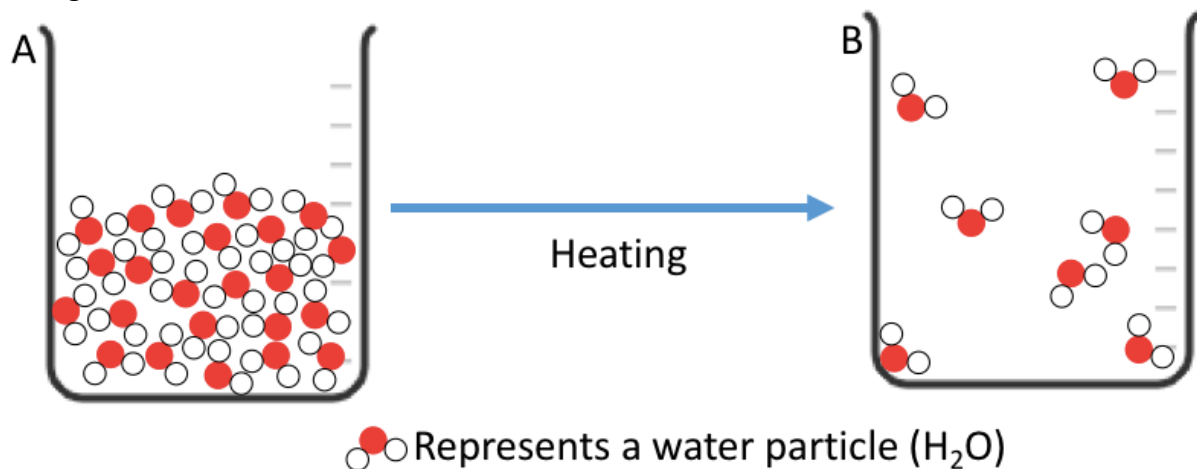
Because there are two types of particles that are not chemically joined together.

(d) What method could be used to separate the sugar from the water? (1)

Evaporation

**Question 10 (6 marks)**

The below diagram represents a beaker of water being heated until all of the water has changed state.



(a) What is this change of state called? (1)

Evaporation OR Vaporisation

Evaporation

(b) In what state of matter (solid, liquid or gas) are the water particles in beaker B? Justify your answer. (2)

Gas, because the particles are all spread far apart and randomly arranged

(c) Is this a physical or chemical change? Justify your answer. (2)

Physical change no new type of particle is formed.

OR Physical change as no new substance is formed.

(d) Mass does not appear to be conserved (the same) during this change of state. Suggest a reason why. (1)

The beaker is open to the air so the water particles are free to escape.

### Question 11 (4 marks)

Use the following terms to fill in the blanks of the paragraphs. (4)

#### Temperature, surface area, concentration, catalyst

- Increasing the **Temperature** \_\_\_\_\_ of the reactants means the particles will have more energy and will move about more. This will cause more collisions and give the particles more energy for an effective collision.
- Increasing the **Surface area** \_\_\_\_\_ means more reactant particles will be exposed. This means there will be more collisions between reactants causing the products to form at a faster rate.
- Increasing the **Concentration** \_\_\_\_\_ of reactants means there will be more particles and hence more collisions. This will cause the products to form at a faster rate
- Adding a **Catalyst** \_\_\_\_\_ decreases the amount of energy needed for an effective collision. Therefore, more collisions will be effective and cause the products to form at a faster rate.

### Question 12 (13 marks)

Hydrochloric acid is a liquid and calcium carbonate (solid) react to form bubbles of carbon dioxide gas.

A student was asked to investigate what effect temperature had on the rate of reaction between hydrochloric acid (HCl) and calcium carbonate (CaCO<sub>3</sub>).

(a) Write a suitable hypothesis for this investigation. (2)

If I increase the temperature then I think the rate of reaction will increase.

(b) What is the independent variable for the experiment? (1)

Temperature

(c) What is the dependent variable for the experiment? (1)

Rate of reaction

(d) Give a control variable for the experiment? (1)

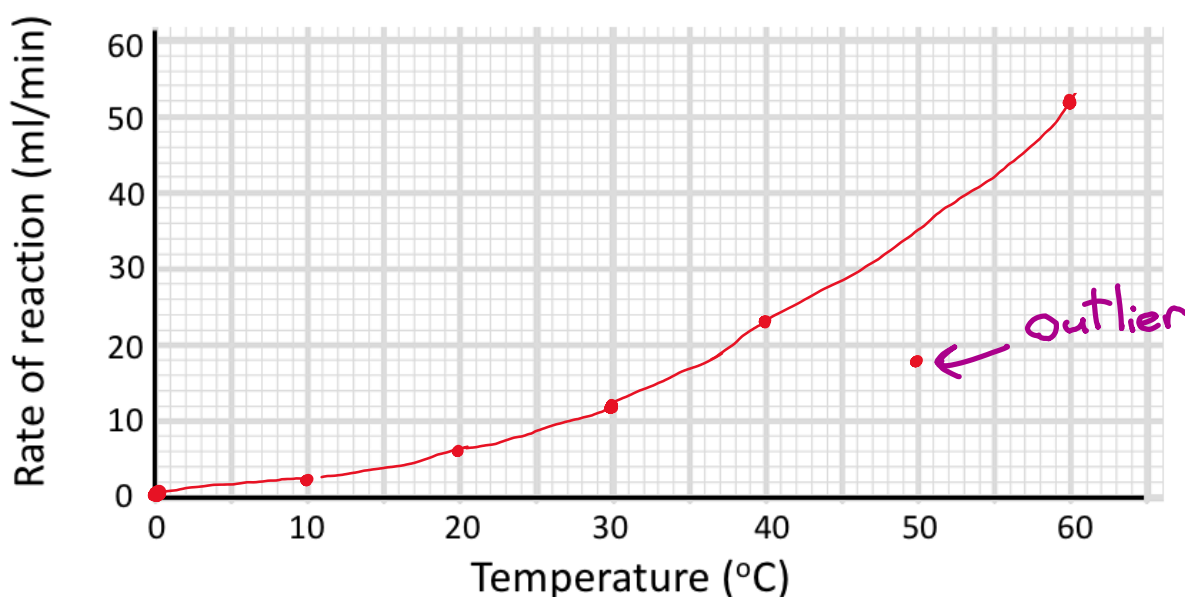
Surface area OR concentration or reactants

(e) What laboratory instrument could have been used to measure the temperature during the experiment? (1)

Thermometer

(f) The student collected the following data for the volume of gas produced per minute at various temperatures . Plot the data on the graph paper provided. (4)

Temperature (°C)	0	10	20	30	40	50	60
Rate of reaction (Volume of gas produced per minute (ml/min))	0	2	6	12	23	18	52



(g) One of the recorded volumes of gas produced per minute is an outlier (is inconsistent) with the others. Which one? (1)

The rate of reaction for the temperature of 50°C

(h) Does the data support the hypothesis you wrote? Explain your answer (1)

Yes, when the outlier is ignored the rate of reaction increases as the temperature

increases

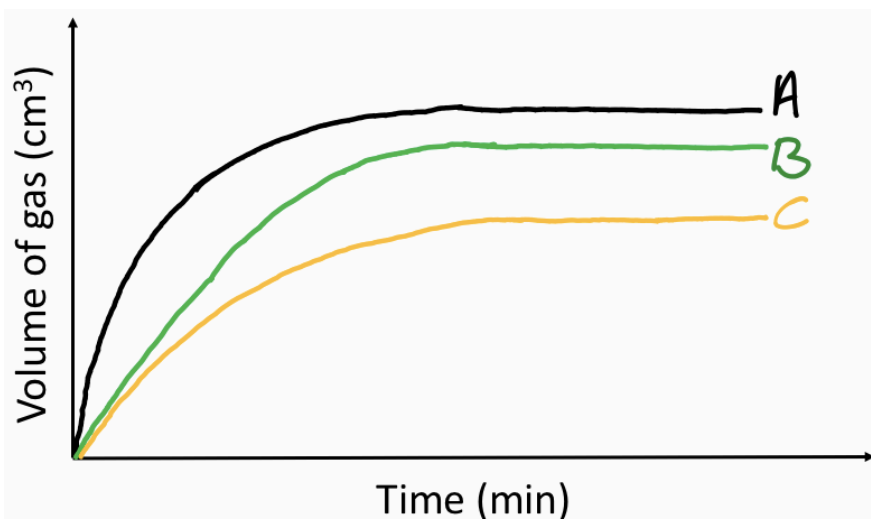


(i) Give one advantage of using a graph to present data. (1)

Outliers are easier to spot. OR Trends in the data are easier to see. Or Large amounts of data can be presented easily.

**Question 13 (5 marks)**

Hydrogen peroxide is a liquid which undergoes a reaction with the catalyst manganese dioxide (solid) to produce oxygen gas. Three experiments (A, B and C) of this reaction are recorded in the graph below. Study the graph and answer the following questions.



(a) Which curve (A, B or C) had the fastest rate of reaction at the beginning? Justify your answer (2)

A, because the slope is steeper than B and C.

(b) Suggest one difference between the experiments which could have caused this reaction happened at a faster rate. (1)

Higher temperature. OR Greater surface area OR smaller particle size. OR A had a catalyst present. (Any one)

(c) Which curve (A, B or C) had the most reactants (eg. more hydrogen peroxide)? Justify your answer. (1)

A, because a greater volume of gas was produced when the reaction was finished.

(d) How could you test for the oxygen gas which is produced? (1)

Place a glowing wooden splint into the container of the gas. If it relights oxygen is present. OR oxygen will relight a glowing wooden splint

If finished feel free to colour in this picture.

Happy Christmas to the best students!

