

# 2<sup>nd</sup> Year Science, Summer 2023

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

Answer all questions in the spaces provided.

Periodic table of the elements

1											18																				
1 H 1.008											2 He 4.003																				
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18														
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95														
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.87	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.41	31 Ga 69.72	32 Ge 72.64	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80														
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (97.90)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3														
55 Cs 132.9	56 Ba 137.3	57 La 138.9	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (144.9)	62 Sm 150.4	63 Eu 151.9	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 174.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209.0)	85 At (210.0)	86 Rn (222.0)
87 Fr (223.0)	88 Ra (226.0)	89 Ac (227.0)	104 Rf (261.1)	105 Db (262.1)	106 Sg (266.6)	107 Bh (264.1)	108 Hs (277.0)	109 Mt (268.1)	110 Ds (271.0)	111 Rg (272.2)	112 Uub (285.0)	113 Uut* (289.0)	114 Uuq (289.0)	115 Uup* (289.0)	116 Uuh (289.0)	117 Uus* (289.0)	118 Uuo (293.0)														

Good luck!

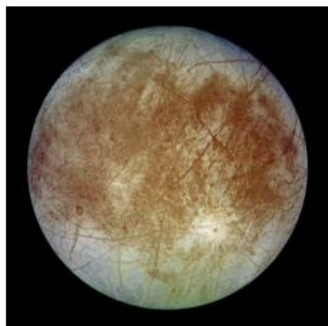
Question	Marks	Awarded
<b>Total</b>	<b>88</b>	
<b>Grade descriptor</b>		

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)

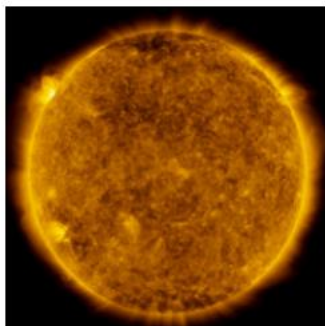
# Question 1

(7)

The images below show three celestial objects found in our solar system. The objects are not shown on the same scale.



Moon



Star



Planet

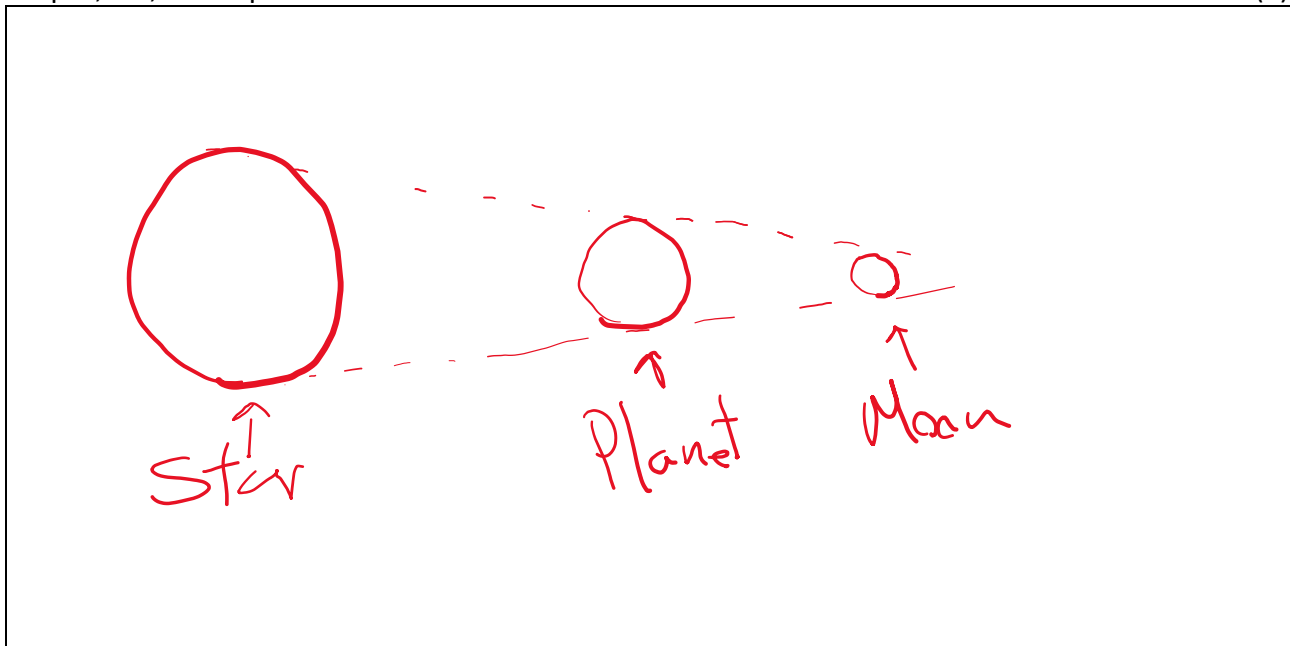
(a) Match the name of each celestial object with the correct description in the table below. (3)

Description	Name of celestial object
Consists of burning gas	Star
Orbits a planet	Moon
Orbits a star	Planet

(b) Which of the celestial objects above has the largest diameter? (1)

Star

(c) Draw a labelled diagram to show the positions of a moon, a star and a planet during a lunar eclipse, i.e., an eclipse of the moon. (3)



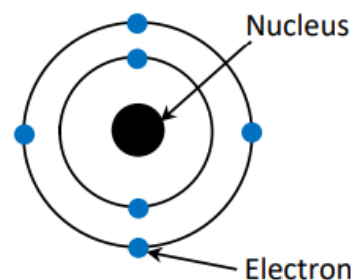
## Question 2

(5)

An atom of element X is shown in the diagram.

- (a) Name one subatomic particle found in the nucleus of an atom.

Proton or Neutron



- (b) Answer the following question by putting a tick (✓) in the correct box.

The charge on the electron is:

Positive

Negative

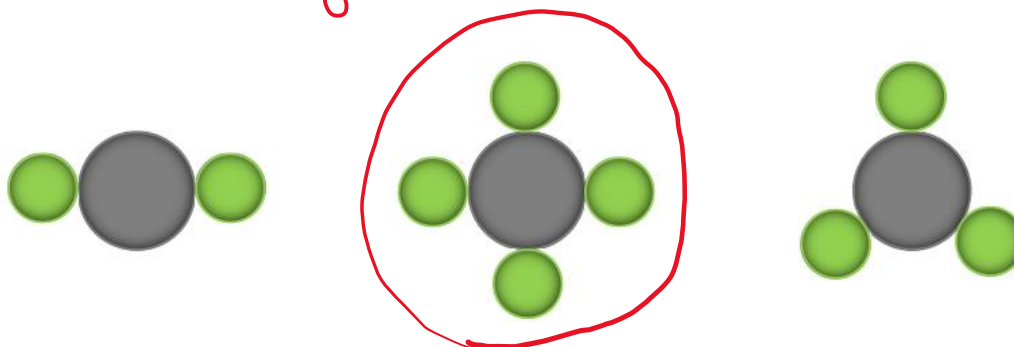
Neutral

- (c) Place an X on the Periodic Table shown below to indicate the position of element X. You may use the Periodic Table on the front of this exam booklet to help you answer this question. (1)

H																			

- (d) Element X forms a compound with hydrogen. Element X is shown in grey. Hydrogen is shown in green. Circle the diagram below which represents the compound formed. Justify your answer. (2)

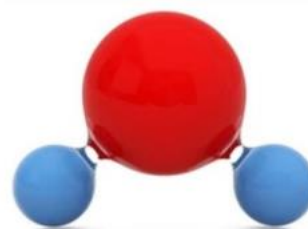
Carbon is in group 4 and so needs 4 hydrogen atoms to have a full outer shell of 8 electrons



### Question 3

(5)

Water is a colourless, tasteless substance. Water contains hydrogen and oxygen chemically combined.

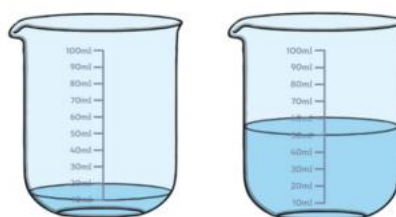


(a) The picture on the right shows a model of a water molecule. The chemical formula for water is  $H_2O$ . Does the big sphere in the model represent hydrogen or oxygen? (1)

Oxygen

(b) In the diagram below both beakers contain pure water at  $20^\circ C$ . Which one of the properties listed below is the same for the water in each beaker? Put a tick in the correct box. (1)

- Mass
- Weight
- Density
- Volume



A student investigated the solubility of a compound in water. She added some of the compound to  $50\text{ cm}^3$  of water at  $20^\circ C$  and stirred the mixture until the compound was completely dissolved. She repeated this until no more of the compound dissolved. She found that the greatest mass of the compound that she was able to dissolve was 15 g.

(c) Calculate the solubility of the compound in  $\text{g/cm}^3$  (grams for  $1\text{ cm}^3$ ) (1)

calculation

15g in  $50\text{ cm}^3$  ( $\div 50$ )

0.3g in  $1\text{ cm}^3$

(0.3g/ $\text{cm}^3$ )

(d) Describe two things that the student could have done to allow a greater mass of the compound to be dissolved. (2)

Increase the temperature of the water

Increase the volume of the water

**Question 4**

**(4)**

The photographs below show the Moon as seen from the Earth at certain times during the lunar cycle. The images are not in the correct order.



Image 1



Image 2



Image 3



Image 4

Answer questions (a), (b) and (c) by putting a tick (✓) in the correct box.

(a) Which image, 1, 2, 3 or 4, shows a New Moon?

Image 1

Image 2

Image 3

Image 4

(b) Which image, 1, 2, 3 or 4, shows the Moon during a waxing crescent phase?

Image 1

Image 2

Image 3

Image 4

(c) Approximately how long is the lunar cycle?

1 day

1 week

1 month

1 year

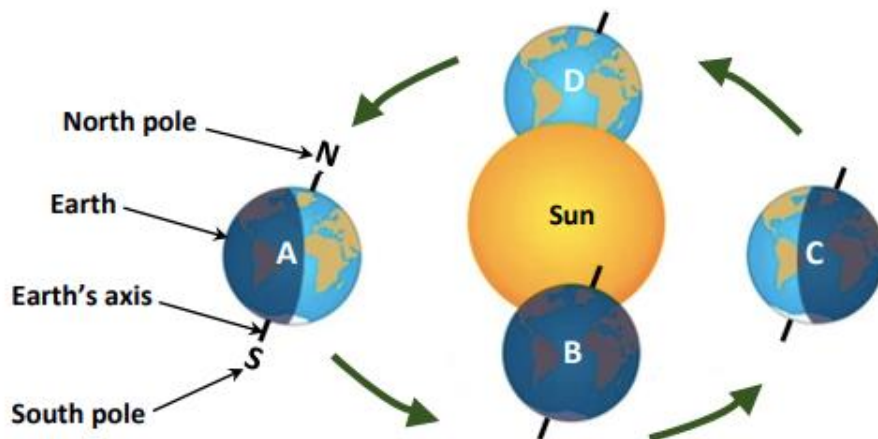
(d) Explain why the Moon is visible from Earth.

*the light from the sun reflects from the moon*

### Question 5

(10)

The diagram shows the movement of the Earth around the Sun. The letters A, B, C and D represent four positions of the Earth as it moves around the Sun.



(a) Starting at position A, what will be the position of the Earth when 18 months have passed? Put a tick (✓) in the correct box. Position A Position B Position C Position D (1)

Position A  Position B  Position C  Position D

(b) Which letter, A, B, C or D, represents the position of the Earth during summer in the northern hemisphere? Justify your answer. (2)

*A, because the northern hemisphere is tilted towards the sun*

(c) Select a letter, A, B, C or D, which represents a position of the Earth when day and night last approximately the same length of time. (1)

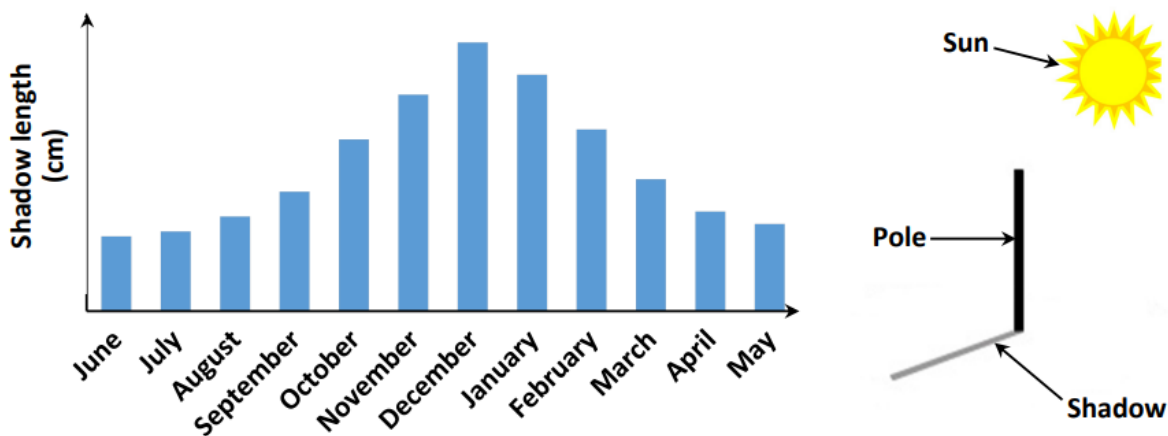
Position A  Position B  Position C  Position D

*← Either*

(d) Which one of the following statements explains why seasons occur on Earth? Put a tick (✓) in the correct box. (1)

- The Moon moves around its axis.
- The tilted Earth moves around the Sun.
- The tilted Earth moves around its axis.
- There are sunspots on the surface of the Sun.

The length of the shadow cast by an object depends on the position of the Sun in the sky. Two groups of students in Ireland, group A and group B, investigated how the length of a shadow varied over a year. The graph below shows the results obtained by group A, who used a pole to cast the shadow.



(e) Name an instrument the students could have used to measure the length of the shadow. (1)

meter stick

(f) State one variable the students in group A should have kept constant. (1)

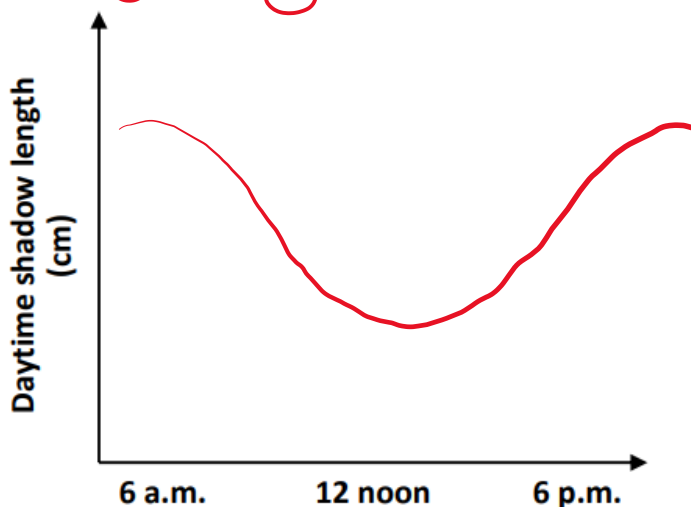
length of the pole

(g) Group B carried out the same investigation, but instead of using a pole to create a shadow, they used a student from the group. Which group, A or B, carried out a better investigation? Justify your answer. (2)

Group A. the length of the pole will not change but a person might grow

Group A also investigated how the length of the shadow cast by the pole changed during a sunny day in June.

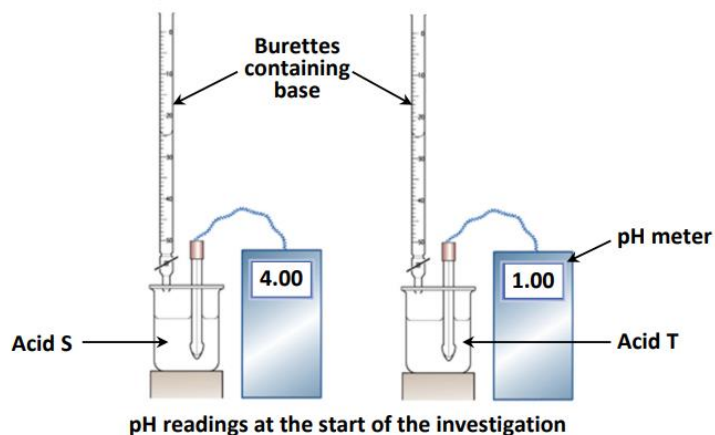
Using the axes on the right, sketch the curve the students should have obtained.



## Question 6

(5)

A student was given two acids, **S** and **T**. She set up the apparatus shown below to investigate how the pH of **S** and **T** changed when they reacted with a base. The diagrams below show the pH of **S** and **T** at the start of the investigation.



(a) Which acid, S or T, was more acidic at the start of the investigation? (1)

T

(b) State one safety precaution the student should have followed when handling the acids. (1)

safety goggles

The student opened the tap on each burette and allowed the base to flow into the beakers of acid. The changes in pH were recorded as the base was added. The graph shows both sets of results. (3)



(c) What was the pH of the solutions when 50 cm<sup>3</sup> of base had been added?

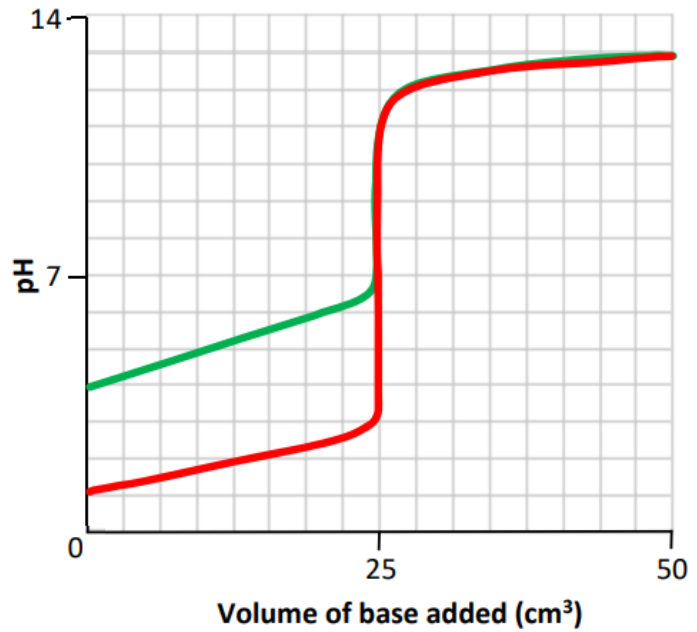
13

(d) What is the pH of a neutral solution?

7

(e) Identify a laboratory base the student could have used in this investigation.

Sodium hydroxide



## Question 7

(5)

Read the article below and answer the questions that follow.

### What's This Big Bang All About?

In 1927, an astronomer named Georges Lemaître had a big idea. He said that a very long time ago, the universe started as just a single point. He said the universe stretched and expanded to get as big as it is now, and that it could keep on stretching.

(a) Henrietta Swan Leavitt made perhaps the most important discovery in the history of astronomy. She studied a particular type of star which allowed astronomers to measure the size of the universe. Edwin Hubble used her work to measure the distance of galaxies. He noticed that all other galaxies were moving away from us. This means that the universe is expanding and is evidence to support the big bang theory.



Henrietta Swan Leavitt

(b) The Big Bang theory predicts that the early universe was a very hot place and that as it expands, would then cool, and give out a type of energy called radiation that is left over from the Big Bang, called the "cosmic microwave background". This cosmic microwave background radiation is additional evidence to support the big bang theory. The estimated age of the universe is 13.8 billion years old.

Source: Adapted from NASA.gov

(a) Why was Henrietta Swan Leavitt's work so important?

(1)

Find the answers in the text

(b) What did Edwin Hubble observe about galaxies? (1)


(d) Outline two pieces of evidence mentioned in the article that support the big bang model. (2)


(c) What is the estimated age of the universe? (1)

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**Question 8 (6)**

a) Using the following list of celestial bodies, complete the following definitions. (4)

**Solar system, galaxy, star, asteroid.**

A Solar system is made up of a **star** and all of the objects that **orbit around it**.

A star is a large ball of gas that gives off **heat and light**.

A galaxy is a collection of many **millions of stars**.

A asteroid is a small object composed of rock. Too small to be a planet.

What is the difference between a moon and a planet? (2)

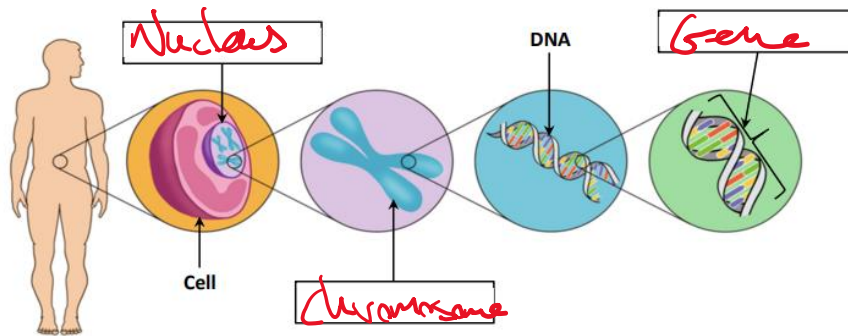
a moon orbits a planet but a planet orbits a star
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**Question 9 (6)**

The diagram illustrates the organisation of genetic information within human cells. Some of the labels are missing.

a) Use each of the words listed below to complete the labels on the diagram below. (3)

**Chromosome                  Nucleus                  Gene**



(b) Name an instrument which could be used in the laboratory to view human cells. (1)

Microscope

A normal human brain cell contains 46 chromosomes. Answer questions (c) and (d) by putting a tick (✓) in the correct box. (1)

(c) How many chromosomes are present in a human sperm cell?

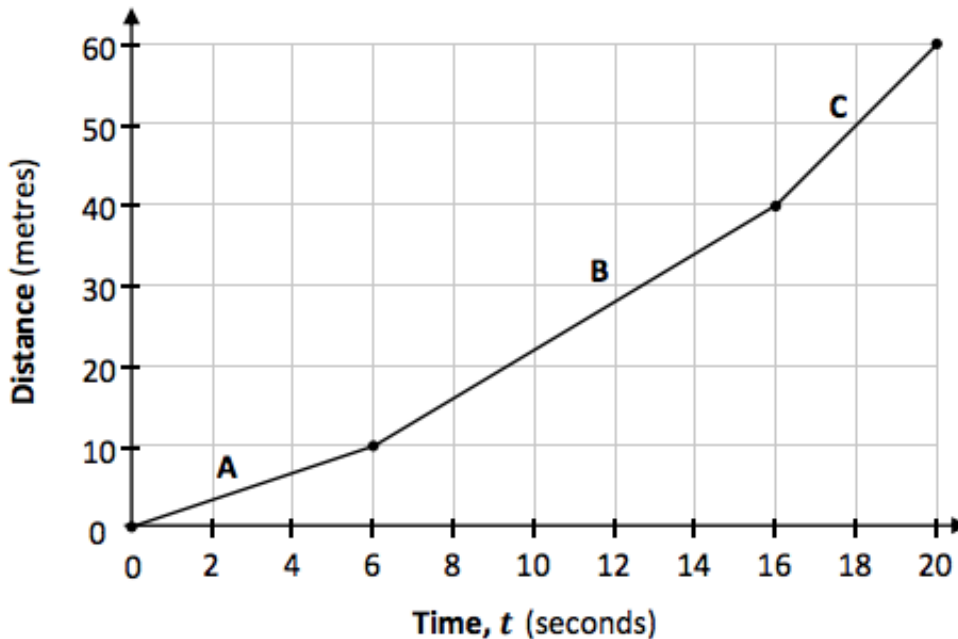
- 23       46       69       92

(d) The sperm cell fertilises an egg cell. How many chromosomes should be present in the resulting zygote? (1)

- 23       46       69       92

**Question 10** (7)

Martin took part in a 60 metre race. The graph below shows his distance-time graph. The graph is in three sections, labelled A, B, and C



(a) How many seconds did it take Martin to finish the race? 20s (1)

(b) What distance had Martin travelled after 16 seconds? 40m (1)

(c) Which was Martin's fastest section (A, B, or C) of the race? Justify your answer. (2)

C as the slope was the steepest

(d) Find Martin's speed during his fastest section of the race, include the units in your answer. (3)

$$\begin{aligned} \text{speed} &= \frac{\text{Dist}}{\text{Time}} \\ &= \frac{20\text{m}}{4\text{s}} \\ &= 5\text{m/s} \end{aligned}$$
$$\begin{aligned} \text{Time} &= 20 - 16 = 4\text{s} \\ \text{Dist} &= 60 - 40 = 20\text{m} \end{aligned}$$

### Question 11

(13)

Different chemical reactions happen at different rates.

A group of students set up an experiment to show how they produced a common laboratory gas.



(a) Name a common gas that could be produced in the laboratory. (1)

Find this in the CWT class notes  
on my website

(b) Draw a labelled diagram of how this gas could be produced. Include labels for any equipment and chemicals used. (4)

See class powerpoint

(c) Explain how you tested this gas to confirm its identity. Include the result of the test. (2)

See class power point.

(d) A student carried out an experiment to investigate the effect of concentration on the rate of production of a certain gas. The first reaction happened at a lower concentration of liquid reactant and the second one at a higher concentration of liquid reactant.

In both cases the gas produced was passed through water as it was collected. This was to ensure that the gas was always at room temperature (a constant) when its volume was measured.

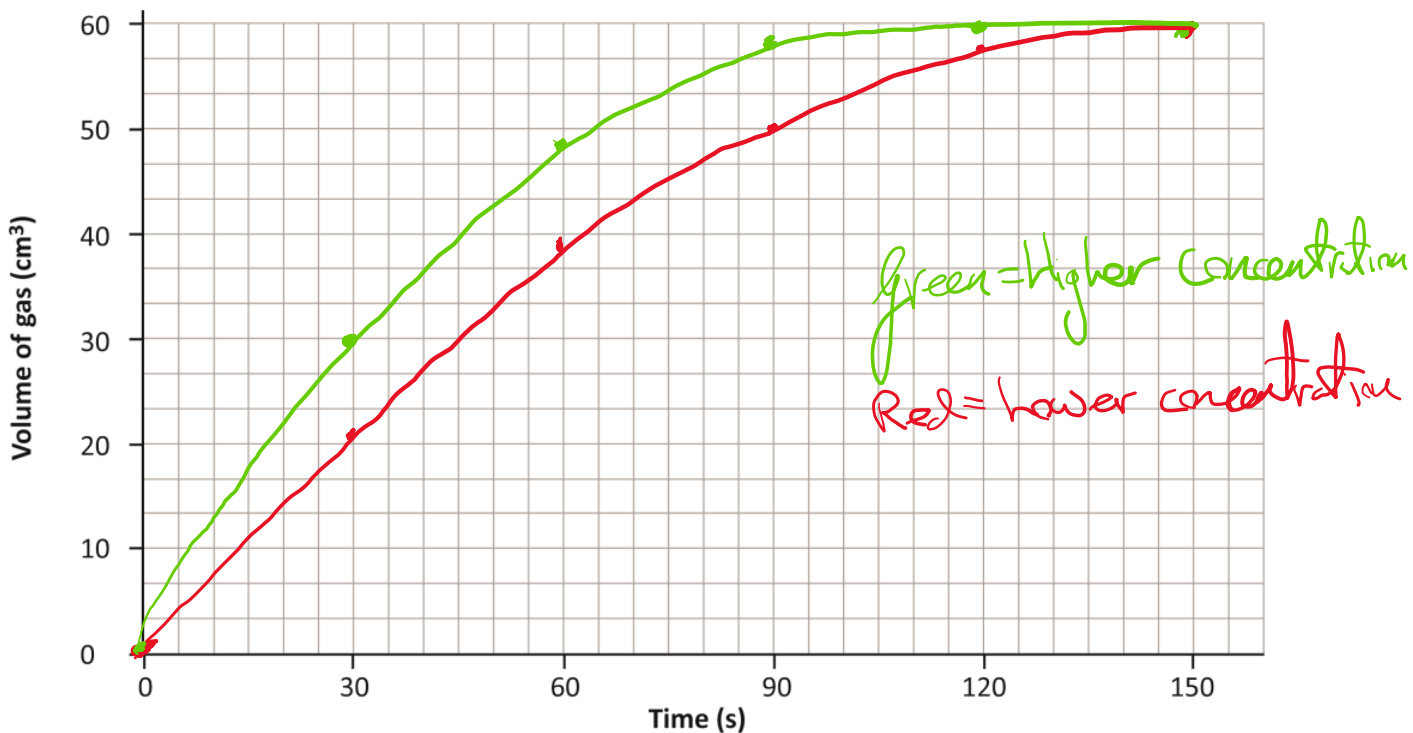
Suggest a reason why it would be recommended to repeat an investigation several times? (1)

to ensure the result is reliable

The student recorded the following results:

Time (s)	Volume of gas (cm <sup>3</sup> ) from reaction with lower concentration of liquid reactant	Volume of gas (cm <sup>3</sup> ) from reaction with higher concentration of liquid reactant
0	0	0
30	21	30
60	39	48
90	51	57
120	57	60
150	60	60

In the space below, draw graphs for both sets of results. (4)



(f) State a conclusion that the student could have drawn from the results. (1)

The higher concentration had a faster rate of reaction at the beginning

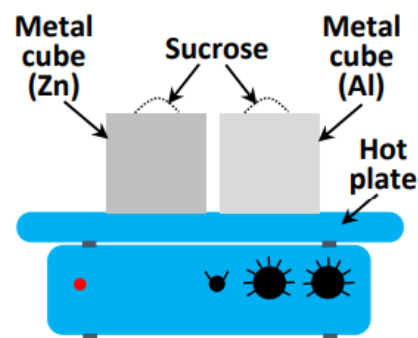
## Question 12

(15)

A student carried out a series of experiments to investigate the properties of sucrose (table sugar).

In the first experiment, the student investigated the melting point of sucrose.

Two metal cubes of equal volume were placed on a hotplate as shown in the diagram. One was made of zinc (Zn) and the other was made of aluminium (Al). One gram of sucrose was placed on top of each cube and the hotplate was turned on.



(a) What is meant by the melting point of a substance?

(2)

The temperature a substance changes from a solid to a liquid.

(b) Is melting an example of a physical change or a chemical change? Explain your answer. (2)

Physical change as no new substance is formed.

(c) The aluminium cube had a smaller mass than the zinc cube. Explain why. (1)

aluminium is less dense than zinc

(d) The sucrose on the aluminium melted before the sucrose on the zinc. What does this result tell us about the two metals? Put a tick (✓) in the correct box. (1)

Aluminium is a better conductor of heat than zinc.

Aluminium has a higher melting point than zinc.

Aluminium is less reactive than zinc.

Aluminium atoms have less neutrons than zinc atoms.

(e) Explain why the sugar melted but the metals did not. (1)

Sugar has a lower melting point than the metals

(f) Aluminium and zinc are metals. State two properties of metals. (2)

good conductor of heat  
good conductor of electricity  
high melting point.

In the second experiment the student dissolved sucrose in water. They used some of the following components to investigate if the resulting solution could conduct electricity.

Buzzer

Wires

Bulb

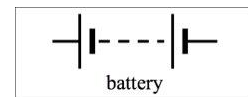
Battery



dordánai

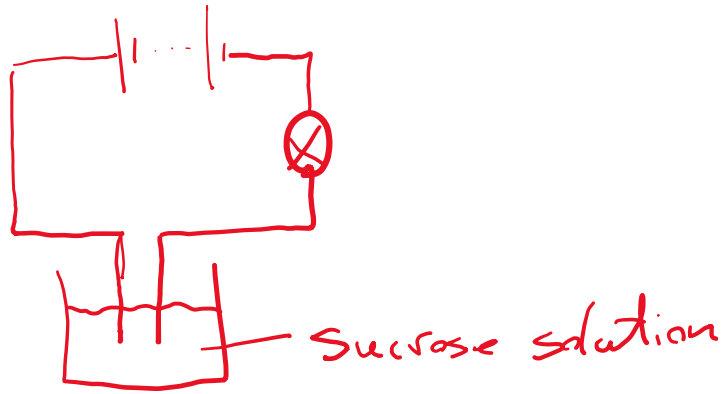


buzzer



(g) Using electrical circuit symbols, draw a labelled diagram of a circuit the student could have used to carry out this investigation. (3)

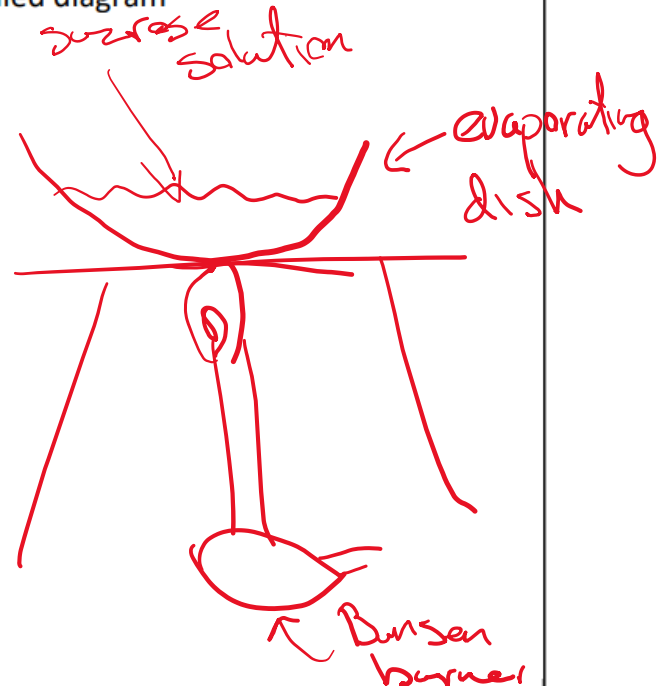
Labelled diagram



(h) The student was then given the task of separating the sucrose from the water. Describe how the student could have separated these two substances. You should include a labelled diagram in your answer and indicate the location of the sucrose at the end of the separation. (3)

- Set up the experiment as shown.
- using the bunsen burner heat the solution
- the water will evaporate
- the sugar will be in the evaporating dish.

Labelled diagram



Thank you for being the best students. It has been a pleasure to do science with you this year.

Enjoy the summer and see you in 2<sup>nd</sup> year!

If you are finished early, work away on the wordsearch below.

## Atoms and molecules



J N Q T H A J V C I P S L L Z O H J P N M F U V  
 H Y O Y C O I E I H B A P U S U T I R C O M E D  
 Q D W N Y O S L O B M Y S L A C I M E H C E D H  
 A B I L Q P O S I T I V E C H A R G E R G N G E  
 P B X J W D P Z T T C U N E U T R O N A Z V U K  
 X Z S H P E L E C T R O N Y L K J A Z Q U U Z H  
 P M R Q T I H J H O W B Z C T I M U I O V J B E  
 O K R P Q F N K A Y H Y L Q T Z C P H U O J A V  
 R C E G R A H C E V I T S O P I K Z U I R E S A  
 B C W F E F L P L H P X M H M A J I F H C R S F  
 I N F A U Y W R M T D F O R K H T T O R K F A S  
 T N D Y Q R Q I Z S Y C T M B J O V A H S H M I  
 A B X B Z K E S T F U T K Y K Q T Y H P E G C A  
 L A O R E L A I G L V E Q D J N E T F M L G I Q  
 S E F S E C I U K H H R L B V F A R N X U T M H  
 F H M M B Y Z A K H I G V C L Q T T Z C C Y O Z  
 U J E A Y L J K P O V F J E U A O I Y G E C T C  
 V N H T C G D R T K C X F N Z N M U D G L Y A V  
 T C Y E O I F M N B L P S Q Q I S G J T O Q U D  
 R Z N E G A T I V E C H A R G E X N R U M Q X O  
 P E R I O D I C T A B L E Q U E I C N U I H X T  
 G M B L T I D F F G E U X O N C U O O X I P N U  
 P X C K D Y M S B Z G R R X E P J U A I R P R C  
 E F C F F F Q T D Q J E M Q H P R O T O N R K J

positive charge  
 chemical symbol  
 periodic table  
 nucleus  
 democritus

negative charge  
 atomic mass  
 positive charge  
 neutron  
 molecules

element  
 orbitals  
 electron  
 proton  
 Atoms