1st Year Science, Summer 2023

Student Name _____

Answer all questions in the spaces provided.

Periodic table of the elements

1												13	14	15	16	17	18
1 H 1.008	2																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	3	4	5	6	7	8	9	10	11	12	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	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*	114 Uuq (289.0)	115 Uup*	116 Uuh (289.0)	117 Uus*	118 Uuo (293.0)

Good luck!

Question	Marks	Awarded
Total	62	
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

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 while a planet orbits a star

Question 2

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.

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

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)

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

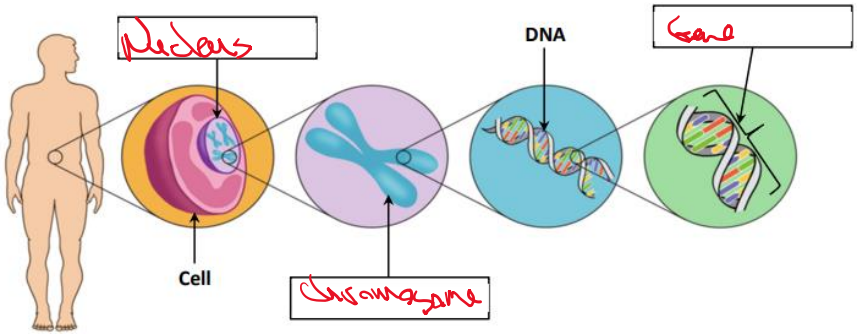
(d) Outline two pieces of evidence mentioned in the article that support the big bang model. (2)

Question 3

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 4

Coat colour in a breed of dog is controlled by a single gene. There are two possible versions (alleles) of this gene – black coat (B) and white coat (b). The gene for black coat is dominant to the gene for white coat.

In their cells, dogs contain two versions of the gene for coat colour. Possible pairs are BB (black), Bb (black) and bb (white).

The table below illustrates a genetic cross between a male dog with genotype Bb and a female dog with genotype bb. The table is incomplete.

(e) Complete the table by writing the two possible genotypes of the offspring that could result from this cross. You may do a punnet square to help you. (2)

	Male dog	Female dog
Parent genotype	Bb	bb
Sex cells produced	B or b	b
Offspring genotype	Bb or bb	

(f) What is the probability of the offspring having a black coat? Put a tick (✓) in the correct box. (1)

0% ☐ 25% ☐ 50% ☑ 75% ☐ 100% ☐

(g) If a different male dog, with genotype BB, was bred with the same female dog, what would be the probability of their offspring having a black coat? Put a tick (✓) in the correct box. (1)

0% ☐ 25% ☐ 50% ☐ 75% ☐ 100% ☑

	b	b
B	Bb	Bb
B	Bb	Bb

Question 5

The theory of evolution by natural selection describes how organisms evolve and change over generations. (a) A student made the following statements about the theory of evolution by natural selection. Indicate if each of the statements is true or false by putting a tick (✓) in the correct column. (2)

Statement	True	False
Evolution involves genetic mutations	✓	
Natural selection is based on competition.	✓	
Natural selection involves survival of the weakest		✓

Organisms can evolve and adapt, making them better suited to their environment. The organisms pictured below have adaptations that help them survive in their habitats. A fox is an omnivore (an animal that eats plant and animal matter). A rose bush is an autotroph (an organism that makes its own food).

Fox

Rose bush

(b) Describe one way a fox is adapted to help it survive in its habitat. (1)

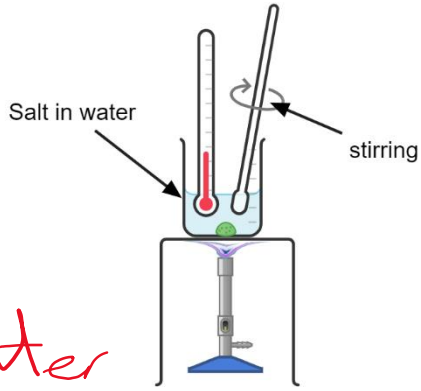
Sharp teeth for catching pray. Fur coat to keep it warm

(c) Describe one way a rose bush is adapted to help it survive in its habitat. (1)

Thorns on the stem to make it difficult to be eaten. Flowers to attract bees to help with
Reproduction

Question 6

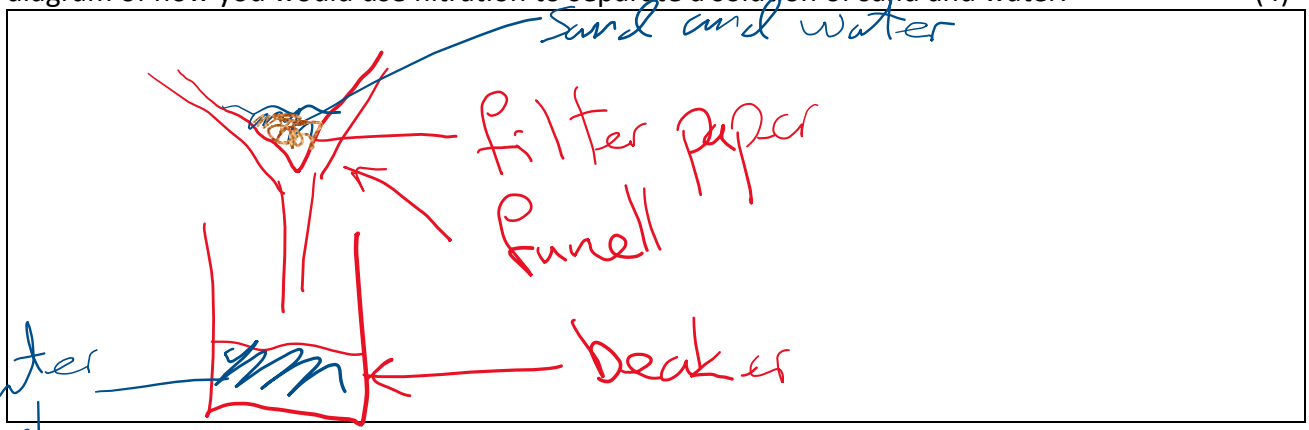
Use the words below to fill the blanks of the paragraph. (4)



Dissolve **Solution** **Water** **Soluble** **Sugar**
Sand **Insoluble**

Some substances Dissolve when you mix them with water
solution to make a transparent liquid called a _____
Substances that dissolve in water are called soluble substances. Substances that do not dissolve in water are called insoluble substances.
Examples of some soluble substances are sugar and salt.
Examples of some insoluble substances are sand and steel.

2. Filtration is used to separate an insoluble substance (eg. sand) from water. Draw a labelled diagram of how you would use filtration to separate a solution of sand and water. (4)



Question 7

Katie was asked to investigate what effect temperature has on the mass of salt which will dissolve in 100 cm^3 of water. She gave her hypothesis which is below:

Hypothesis: "If I **increase** the **temperature** of the water, then I think the **mass of salt dissolve**d in the water will increase.

(a) The independent variable is the variable Katie will change. What is the independent variable in this experiment? Temperature (1)

The diagram of how Katie heated the solution is shown.

(b) Name the instrument in the diagram that is used to measure temperature.
thermometer (1)

(c) Name the device in the diagram used to heat the water

Bunsen burner

(1)

Katie collected the following data on the right.

Temperature (°C)	Mass of salt dissolved in 100 cm^3 of water
20	36.0 g
30	36.6 g
40	37.2 g
50	37.8 g
60	40.4 g

(d) Does the data in the table support Katies hypothesis? Explain your answer using the data in the table. (2)

Yes it does, as the temperature increases so too does the mass of salt dissolved.

(f) Give a safety precaution when using a Bunsen burner in the lab. (1)

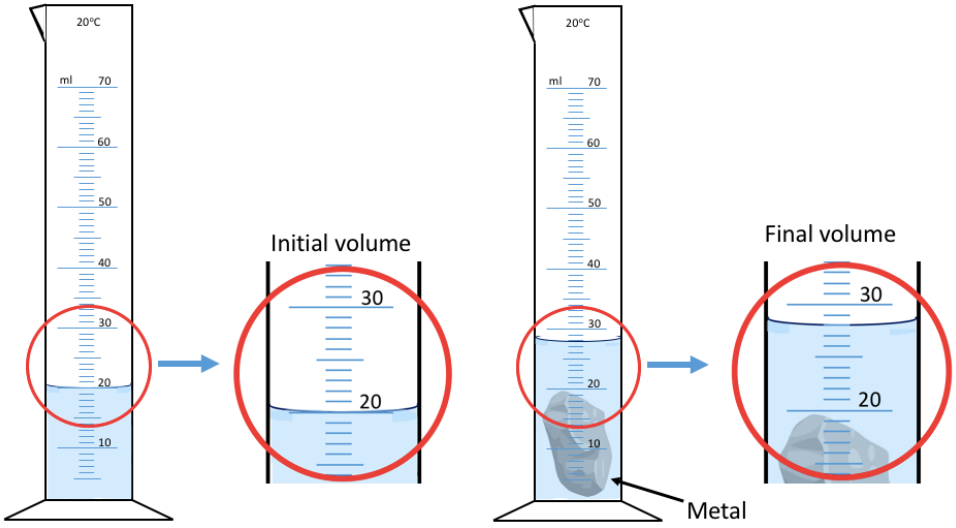
Tie back long hair or wear safety goggles.

(g) Identify one piece of evidence is in the table to show what the investigations were compared fairly. (1)

The mass of salt was always dissolved in 100 cm3 of water

Question 8

Emma wants to find the **volume** of an irregular shaped piece of metal using a graduated cylinder. During the experiment you made the observations as seen in the diagram below.



Study the diagram above for measuring the volume of the metal carefully.

a) After the metal was added, what was the final volume? 28 cm^3 (1)

b) Show that the volume of the metal is 8 cm^3 28-20 = 8 cm^3 (1)

Afterwards, Emma then measured the **mass** of the metal to be **62.4 g**. She now wants to calculate the density to identify the type of metal is made of.

Use the correct formula to calculate the density of the metal. **Include the unit in your answer. The mass of the metal is 62.4 g and the volume is 8 cm^3** (3)

Calculation

Density = mass / volume

mass = 62.4 g

Volume = 8 cm^3

= 62.4 g / 8 cm^3

= 7.8 g/cm^3

Forces and materials

$F = -ks$	Hooke's law
$\sigma = \frac{F}{A}$	stress
$\varepsilon = \frac{\Delta l}{l}$	strain
$E = \frac{\sigma}{\varepsilon}$	Young's modulus
$\rho = \frac{m}{V}$	density
$\mu = \frac{F}{R}$	coefficient of friction
$p = \frac{F}{A}$	pressure

The densities of different metals are given in the table on the right.

Metal	Density (g/cm$^{3)}$
Copper	8.9
Iron	7.8
Lead	11.3
Steel	8.0
Silver	10.5
Mercury	13.5

Using the density, you calculated, identify what type of metal it is. (1)

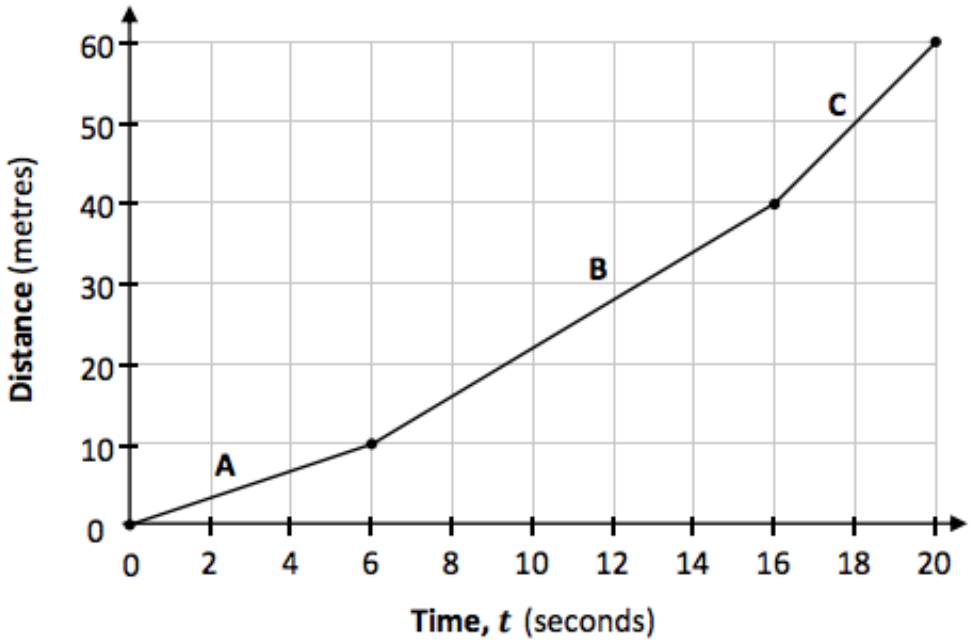
iron

Using the data in the table, explain why a steel hammer would float on liquid mercury. (2)

Because steel is less dense than mercury

Question 9

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? 60s (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, because the slope was steepest in section c

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

Speed = Dist / Time

= 20m / 4s = 5 m/s

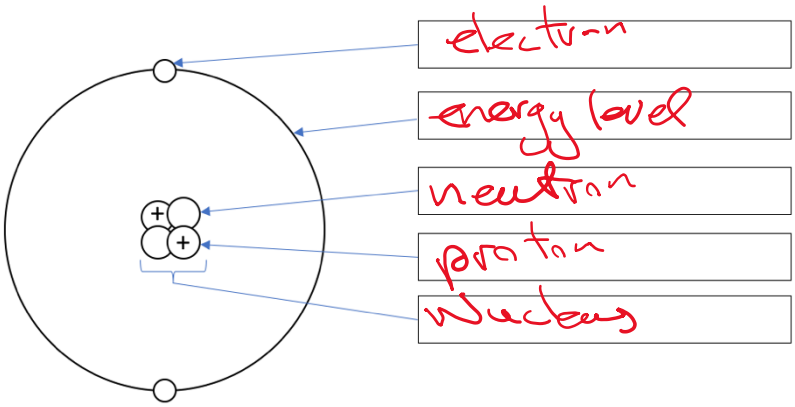
Dist = 60 - 40 = 20m

Time = 20 - 16 = 4s

Question 10

Label the parts of the atom below with the correct word. (3)

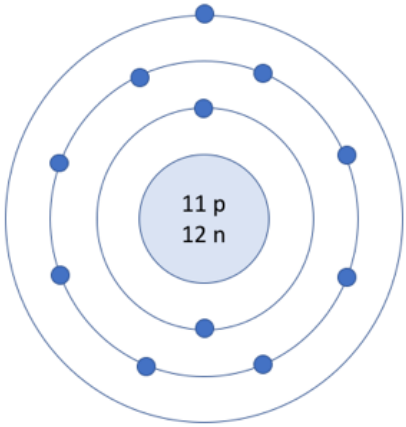
Proton **Neutron**
Electron **Nucleus**
Energy-level (or shell)



Which sub-atomic particle has a negative charge? Answer electron (1)

Question 11

The image below shows the Bohr model of an atom.



(a) State the atomic number of the atom 11 (1)

(b) State the mass number of the atom 23 (1)

(c) Using the periodic table (on the front of this exam) to identify the element (by name or symbol) that is made up of this type of atom. Answer: Na (1)

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 2nd year!

If you are finished early, work away on the wordsearch and colouring page provided.

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

postive charge
chemical symbol
periodic table
nucleus
democritus

negative charge
atomic mass
positive charge
neutron
molecules

element
orbitals
electron
proton
Atoms