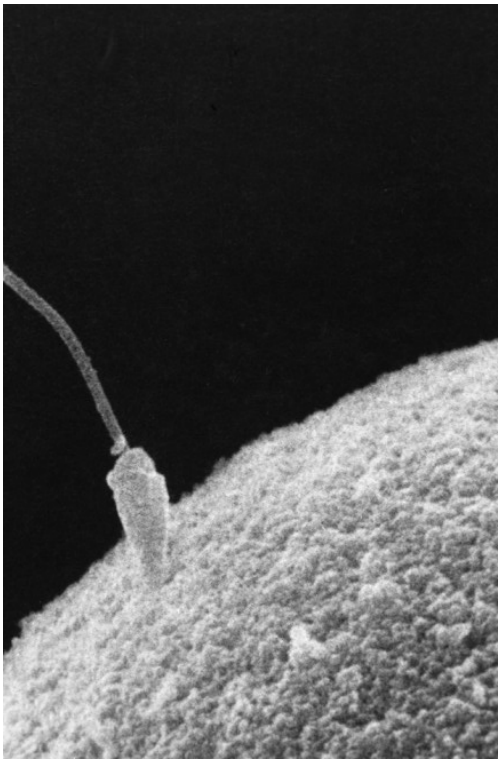
3rd Year Science, Midterm 2022
Time allowed: 1 hour

Mr. A. Goodison

Student Name _____



An image of a sperm fertilising an egg.

Answer all questions in the spaces provided.

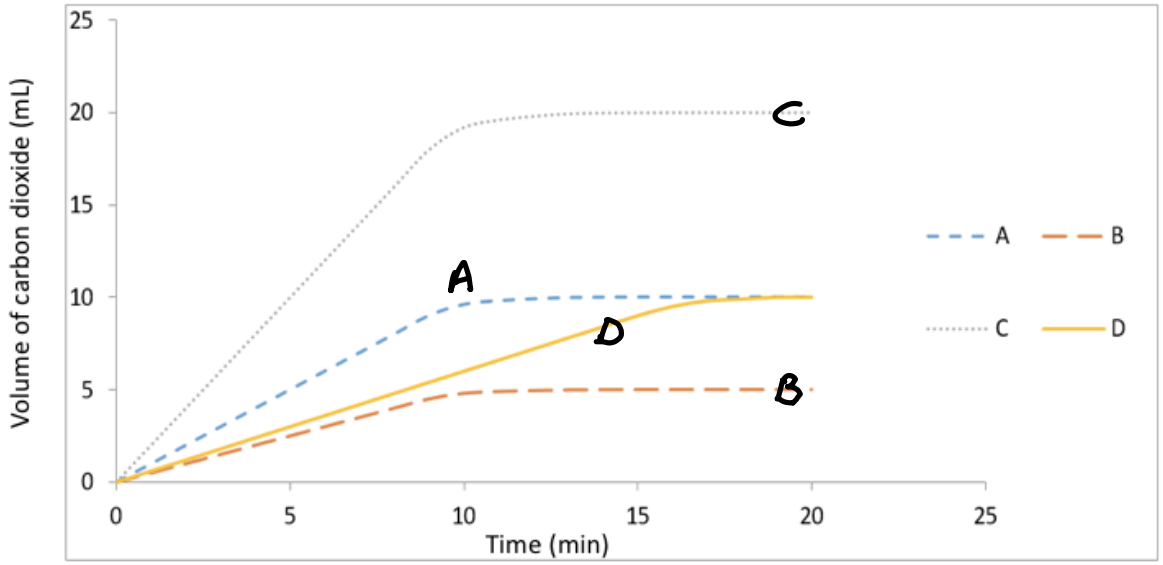
Good luck!

Question	Marks	Awarded
Total	**46**	
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

Hydrochloric acid is a liquid which undergoes a reaction with the calcium carbonate (marble chips) to produce carbon dioxide gas. The graph below shows the volume of hydrogen released (Y-axis) against time (X-axis). In each of the cases labelled A, B, C and D the following variables were kept constant: volume of hydrochloric acid used, and the concentration of hydrochloric acid used.



(b) Which curve (A, B, C or D) had the **fastest** rate of reaction at the beginning? Justify your answer.

(c) In which case, A, B, C or D, was the least mass of marble chips used? Explain your answer. (2)

(d) Explain any one possible difference between the conditions used during case A and the conditions used during case D. (2)

Question 2

A student carried out an experiment to investigate the reaction between an acid and a base. A pH indicator and a thermometer were used to monitor changes in pH and temperature during the reaction.

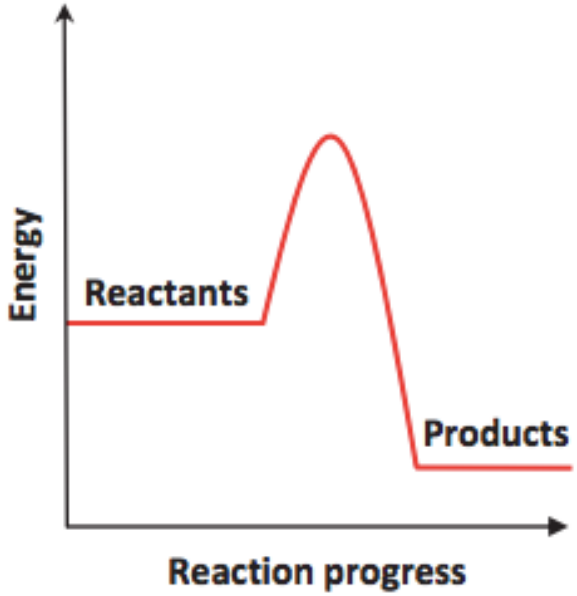
(a) Name a pH indicator the student could have used during this investigation. (1)

(b) What colour is this indicator when placed in acid? (1)

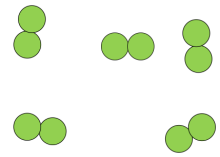
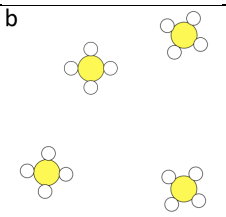
(c) When an acid and a base react, they neutralise each other to produce a neutral solution. On the pH scale, what number represents a neutral solution? (1)

(d) The student noted a rise in temperature as the acid-base reaction took place. Is this an example of an endothermic or an exothermic reaction? (1)

(e) The diagram shows an energy profile diagram for the reaction between an acid and a base. On the diagram, show the activation energy for this reaction. (1)



Complete the table below to decide if these gasses are elements, compounds or mixtures. Justify your answer in each case. (4)

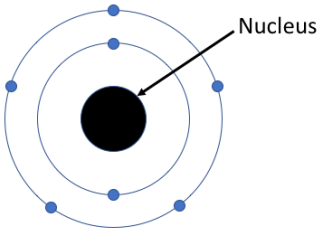
Diagram	Elements, compound or mixture	Justification
a 		
b 		

Question 3

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)

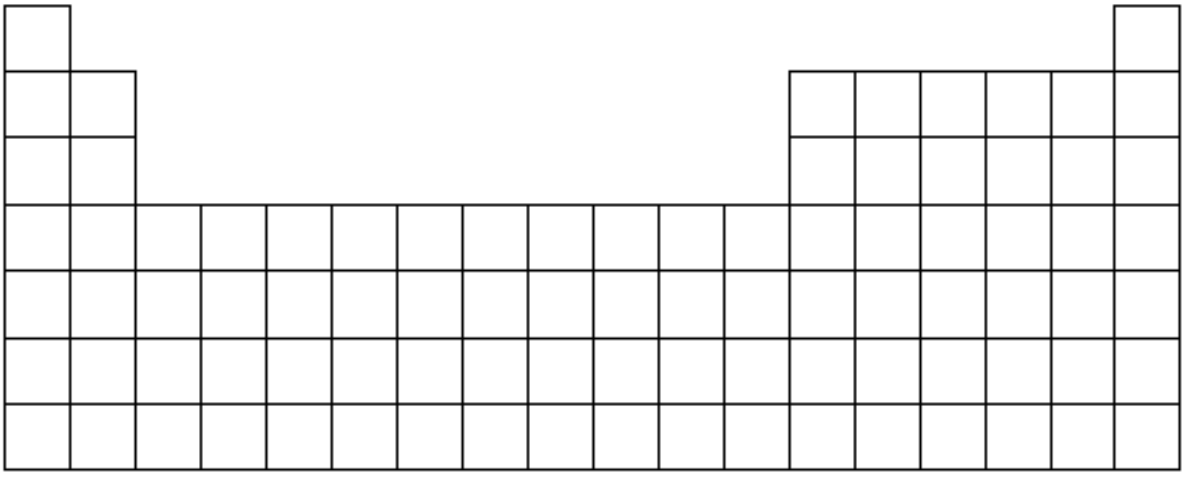
2. An atom of element X is shown in the diagram.



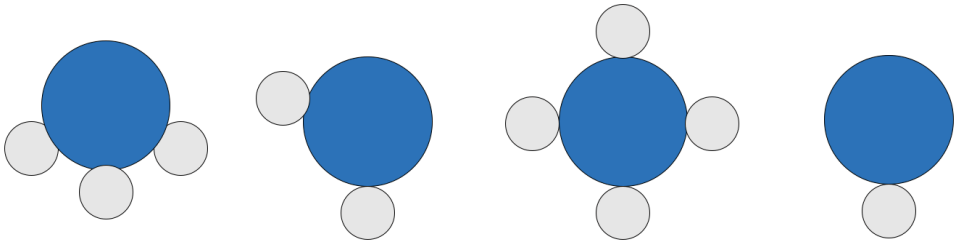
(a) Name one subatomic particle found in the nucleus of an atom. (1)

(b) What charge is on an electron? _____ (1)

(c) Place an X on the Periodic Table shown below to indicate the position of element X. You may use the Periodic Table on page 79 of the Formulae and Tables booklet to help you answer this question. (2)



(d) Element X forms a compound with hydrogen. Element X is the larger atom. Hydrogen is shown as the smaller atoms. Circle the diagram below which represents the compound formed. (2)



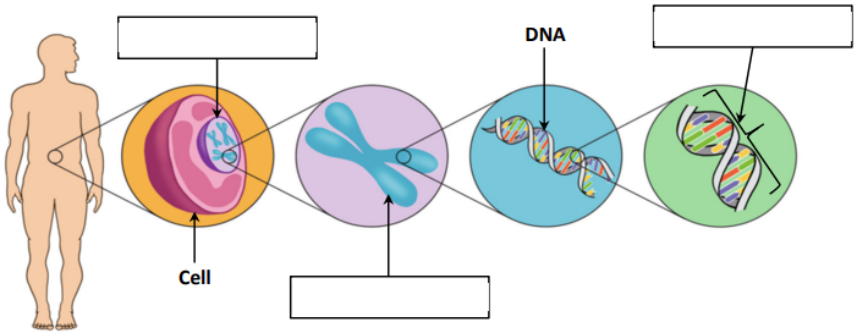
3. Predict the ratio of atoms in a compound containing Aluminium (Al) and Oxygen (O). (2)

Question 4

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. (2)

Chromosome **Nucleus** **Gene**



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

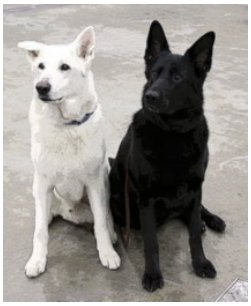
A normal human brain cell contains 46 chromosomes. Answer questions (c) and (d) by putting a tick (✓) in the correct box. (1)

(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 ☐



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. (2)

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

(f) What is the probability of the offspring having a black coat? Put a tick (✓) in the correct box. (2)

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. (2)

0% ☐ 25% ☐ 50% ☐ 75% ☐ 100% ☐

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. (3)

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. (2)

(c) Describe one way a rose bush is adapted to help it survive in its habitat. (2)

Question 6

The energy conversions that happen in a CFL are described in the table below. Complete the table for another device which transforms energy from one form to another and which you designed as part of your studies in science. (2)

Name of the device	**Function of the device**	**Main useful energy conversion**	**Main loss of energy**
Compact fluorescent lamp (CFL)	To provide artificial light	Electrical to light	Electrical to heat

Sketch a Sankey diagram for the device you described in part (d). Label each part of the diagram. (3)