



ALEXANDER ROAD HIGH SCHOOL

MAY 2011

2¹/₂ HOURS

PHYSICAL SCIENCE

CO, MA, KB, IC

TOTAL = 170

GRADE 10

Instructions

- The question paper consists of 11 questions.
 - Answer all the questions
 - Answer section A on the answer sheet provided
 - Answer section B on the folio sheets provided
 - A non-programmable calculator may be used
 - Number the answers correctly according to the numbering system used on this question paper.
 - A data sheet will be provided for your use. DO NOT WRITE ON THEM.
 - Round off to two (2) decimal places unless otherwise stated.
-

SECTION A

- Answer on the answer sheet -

QUESTION 1:

Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (1.1 – 1.5) on the attached ANSWER SHEET.

- 1.1 The rate at which velocity is changing.
- 1.2 The maximum displacement from the position of rest in a wave.
- 1.3 The amount of charge that moves past a point in a conductor in one second.
- 1.4 The electrons that are found in the outer most energy level of an atom.
- 1.5 A teaspoon in a hot cup of coffee becomes hot because of this property of metal, which is possible because there is a sea of delocalised electrons.

[5]

2.6 Four pupils: A, B, C and D had to arrange the following three molecules in order of **DECREASING** polarity.



Which of the four pupils has the correct order?

- | | |
|-----------------------------------|-----------------------------------|
| A. ClF, Br ₂ , BrCl | B. Br ₂ , ClF, BrCl |
| C. ClF, BrCl, Br ₂ | D. BrCl, ClF, Br ₂ |

2.7 Rank the following four molecules in order of INCREASING boiling point...



- | | |
|---|---|
| A. Cl ₂ , HBr, I ₂ , NH ₃ | B. NH ₃ , HBr, Cl ₂ , I ₂ |
| C. I ₂ , Cl ₂ , HBr, NH ₃ | D. Cl ₂ , I ₂ , HBr, NH ₃ |

2.8 A non-spontaneous reaction is associated with a(n) ... of energy

- | | |
|------------------|-----------------|
| A. release | B. absorbing |
| C. exothermic | D. increase |

2.9 In the melting process of water, the breaking of forces occur.

- | | |
|----------------------|----------------|
| A. intramolecular | B. weak |
| C. intermolecular | D. external |

2.10 Which of the following factors DO NOT affect ionisation energy.

- A. Charge of the nucleus.
- B. Distance of the proton from the nucleus.
- C. The number of inner level electrons between the outer electrons and the nucleus.
- D. Force of repulsion between an electron pair in the same orbital.

[2 X 10 = 20]

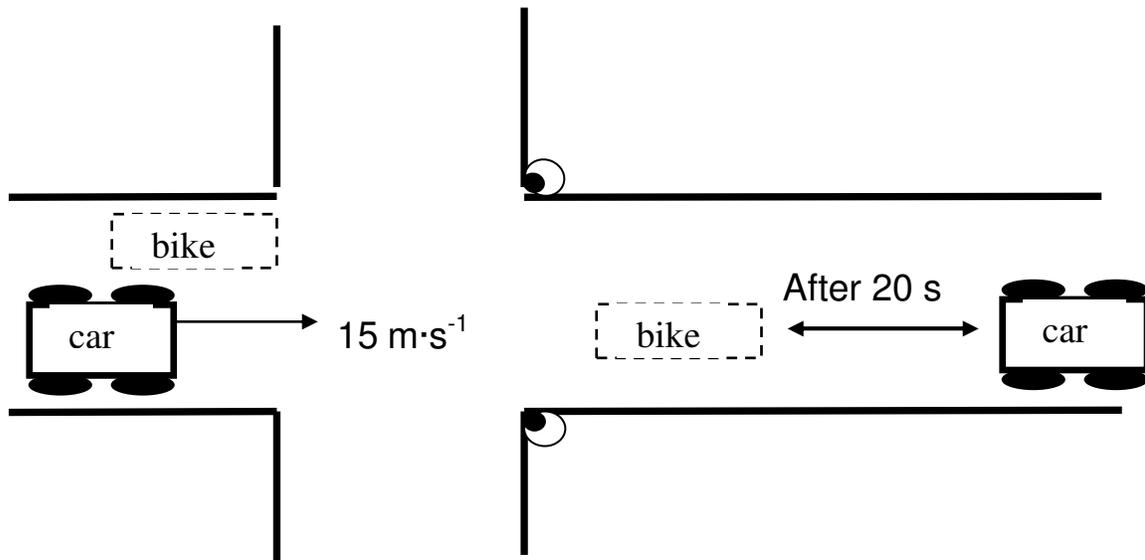
SUB – TOTAL: 25

SECTION B

- Answer all questions on the folio pages provided -

QUESTION 3: Mechanics

3. John, a traffic officer, is waiting on his motorbike at a traffic light for the red light to turn green. The driver of a car, travelling at a constant velocity assumes that the red light will turn green when he gets there, but ends up going through the red light. The car passes the traffic officer and continues with the same velocity. Four seconds after the car passes the traffic officer the light turns green and by then the car is 60m ahead of the bike when the traffic officer starts from REST to follow the car. He accelerates at $0,8\text{m}\cdot\text{s}^{-2}$ for 20s, reaches a maximum velocity, which he then maintains until he is alongside the car.



- 3.1 Show by means of a formula and calculation that the constant velocity of the car is $15\text{ m}\cdot\text{s}^{-1}$. (2)
- 3.2 Calculate the magnitude of the maximum velocity, which the traffic officer attains after 20s of acceleration. (4)
- 3.3 Calculate the distance that separates John and the car, 20s after John started moving. (7)
- 3.4 What advice could be given to this driver when approaching a red traffic light and explain why? (2)

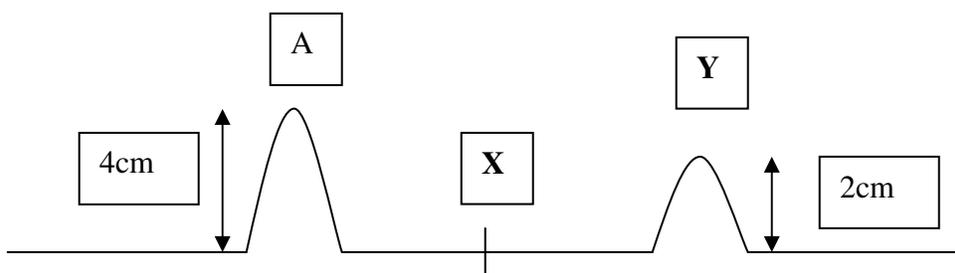
[15]

QUESTION 4: Waves, sound and light

4.1 A standing wave which has 20 half wavelengths, creates a wave in which 45 waves move past a certain point in **one minute**. If the velocity of this wave is $50 \text{ m}\cdot\text{s}^{-1}$ then calculate.

- a) the Frequency of the wave (2)
- b) the Period of the wave (2)
- c) the Wavelength of the wave (3)
- d) the Length of rope needed for this standing wave. (3)

4.2 Look at the diagram below.



- a) Name the type of interference at point **X** (1)
- b) Indicate the height of the resultant pulse at **X**. (2)

4.3 Explain the difference between Frequency and Period in a transverse wave. (4)

[17]

QUESTION 5

5. You were asked to design an experiment in which the relationship between the size of the magnets and the force between the magnets are investigated. You need to give evidence that you understand the Scientific investigation process.

The following subheadings, in no specific order, must all be used whenever asked for. (Variables, Hypothesis, Investigative question, Results, Method, Discussion)

- 5.1 Give the correct order of these subheadings. (2)
- 5.2 What is a hypothesis? Define the term. (1)
- 5.3 Identify the following 3 variables in this experiment:

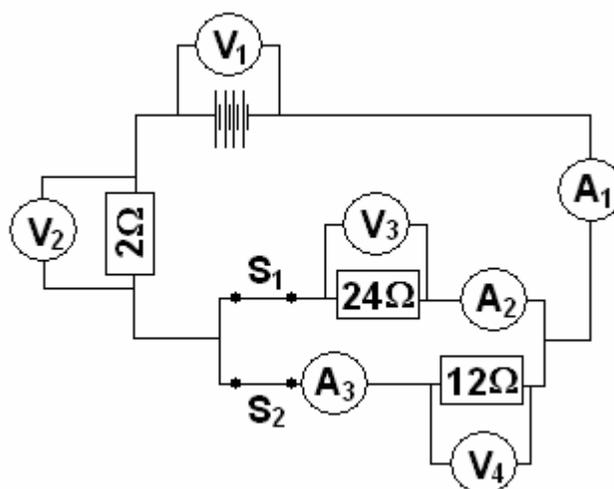
- 5.3.1 Independent (1)
 5.3.2 Dependent (1)
 5.3.3 Control (give only one) (1)
- 5.4 Formulate an investigative question. (2)
- 5.5 Give a table with only 3 possible sets of values for data that you collected in this investigation. (2)
- 5.6 Draw a graph of your results. Show proper graph design skills. (3)
- 5.7 Give a short discussion of the findings (2)
-
- [15]**

QUESTION 6

- 6.1 What is an electrically conducting liquid called? (1)
- 6.2 State the Law of Conservation of charge (2)
- 6.3 Draw a positively charged rod being held **close to** an uncharged free hanging sphere. ONLY show how *polarization* takes place. (Do not show any attraction/repulsion or charge transfer.) (1)
- 6.4 Explain in words, in not more than two lines, what needs to happen for the sphere to become charged. (2)
-
- [6]**

QUESTION 7 (Electric circuits)

Consider the circuit below...



The reading on voltmeter V_1 is 20V, calculate...

- 7.1 The total resistance of the circuit. (3)
- 7.2 The reading on ammeter A₁ (3)
- 7.3 The reading on voltmeter V₂ (3)
- 7.4 The reading on voltmeter V₃ (2)
- 7.5 The reading on ammeter A₂ (3)
- 7.6 Would the reading on ammeter A₁ INCREASE, DECREASE or STAY THE SAME if switch S₁ is opened (1)

[15]

QUESTION 8

- 8.1 Complete the Table. Write **ONLY** the number and answer.

Atom/Ion	Atomic number	Number of neutrons	Number of electrons
Copper (neutral)	<i>8.1.1</i>	30	<i>8.1.2</i>
<i>8.1.3</i> (name)	2	2	2
${}_{16}^{32}\text{S}^{-2}$	<i>8.1.4</i>	<i>8.1.5</i>	<i>8.1.6</i>

(6)

- 8.2 You are given the following the materials and you must choose where each one will best be used in the following scenarios. Write down **ONLY** the number and corresponding letter.

MATERIALS		SCENARIO
8.2.1	copper wire	A. Evaporation techniques used by salt companies
8.2.2	plastic	B. using a separating funnel
8.2.3	magnet	C. Prevention from shocking on electrical wires
8.2.4	sodium chloride and water	D. Conduction.
8.2.5	Muddy water	E. Coins dropped in the sand at the beach
8.2.6	liquids of different densities	F. Filtration to obtain healthy liquid

(6)

8.3 Is 8.2.5 a homogenous or heterogenous mixture? (2)

8.4 68.9257 amu is the mass of 60.4% of the atoms of an element with only two isotopes that appear in nature. The atomic mass of the other isotope is 70.9249

a) Define an isotope. (2)

b) Calculate the relative atomic mass of this element and **NAME** the element. (round off to 4 decimals). (3)

8.5 Write down the chemical formula of the following:

8.5.1 Hydrogen Sulfide

8.5.2 Sodium Hydroxide

8.5.3 Ammonium Sulphate

(3)

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QUESTION 9

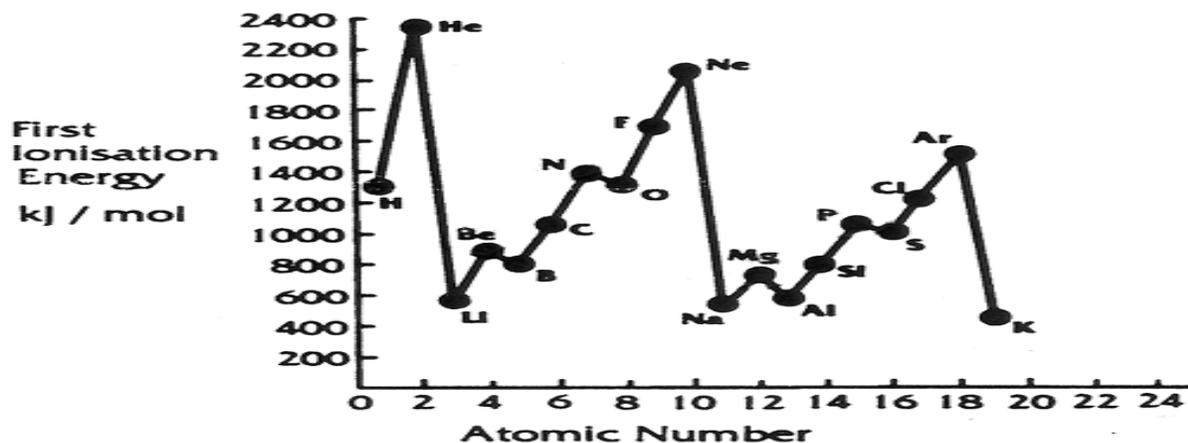
9.1 Draw an **energy level diagram** (Aufbau diagram) for the following and answer the questions that follow:

a) Sulphur atom. (5)

b) Write the electron configuration for this atom. (2)

c) Write the Shortened (condensed) electron configuration for this atom. (2)

9.2 Using the graph answer the following questions.



a) What is the ionisation energy of Neon? (1)

- b) What general trends can be noted with regards to ionisation energy down a group and across a period based on this diagram. (2)
- c) Explain using Aufbau diagrams why Boron and Beryllium do not follow this trend. (5)

[17]

QUESTION 10

10.1 Define Temperature. (3)

10.2 State the difference between Melting and Boiling. (4)

10.3 If 2648 kJ is used to break bonds in the following reaction and the total energy transferred during the reaction is 818 kJ and the reaction is exothermic, calculate the energy released to form bonds.



10.4 Draw a simple graph (free hand) to show the change in temperature of the particles when a block of ice is heated. Only indicate the following labels: Melting point, boiling, name and unit of the vertical axis. (3)

10.5 Explain in not more than 3 lines, the shape of the graph between your indicated melting point and boiling point. (2)

[15]

QUESTION 11 (Bonding)

Hydrides of group 4	Boiling point (°C)	Hydrides of group 6	Boiling point (°C)
CH ₄	-164	H ₂ O	100
SiH ₄	-112	H ₂ S	-61
GeH ₄	-89	H ₂ Se	-42
SnH ₄	-52	H ₂ Te	-2

11.1 Give the lewis structure of H₂O (3)

11.2 What type of bond exist between the atoms in H₂O? (1)

11.3 Is this bond polar or non-polar? (2)

11.4 Is the molecule polar or non-polar? (2)

11.5 Give the couper structure of CH₄ (2)

11.6 What type of intermolecular forces exist between CH₄ molecules? (2)

- 11.7 Why is the boiling point of H_2O so much higher than CH_4 ? (2)
- 11.8 Why is the boiling point of CH_4 so much lower than SnH_4 ? (2)
- 11.9 Oxygen reacts with lithium to form an ionic compound. Use lewis structures to illustrate the formation of this compound. (6)
- 11.10 What type of bonds exist in a piece of pure lithium? (1)
-
- [23]**

TOTAL: 170 MARKS