



**ALEXANDER ROAD HIGH SCHOOL**

JUNE 2016

3 HOUR

**PHYSICAL SCIENCES MID-YEAR EXAM**

CO, KB, MH

TOTAL = 200

**GRADE 10**

**Instructions**

- The question paper consists of 12 questions.
- Answer all the questions.
- Answer section A on the answer sheet provided AND section B on folio sheets.
- Rule off after each question in Section B.
- A non-programmable calculator may be used.
- Number the answers correctly according to the numbering system.
- Round off to two (2) decimal places where necessary.
- Formulas and a periodic table have been included at the end of the question paper

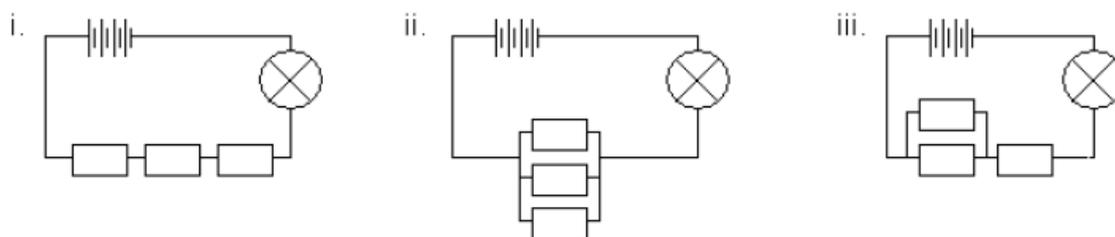
**SECTION A**

- Answer on the answer sheet -

**QUESTION 1: Multiple choice**

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the answer and write down the letter (A–D) next to the question number on the attached ANSWER SHEET.

1.1 Rank the brightness of the bulb in the following circuits from dim to bright:



- A i, ii and iii
- B i, iii and ii
- C ii, iii and i
- D iii, ii and i

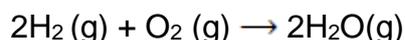
1.2 The equivalent units for  $V \cdot A^{-1}$  and  $C \cdot s^{-1}$  respectively are:

- A A and  $\Omega$
- B  $\Omega$  and A
- C R and I
- D V and A

1.3 The (incomplete) solubility rule for the carbonates is:

- A all carbonates are insoluble except calcium carbonate
- B the carbonates are all soluble except ammonium carbonate
- C all carbonates are soluble except those of the alkali metals
- D all carbonates are insoluble except ammonium carbonate

1.4 Study the equation below:



Which *one* of the statements below are correct?

- A two atoms of hydrogen gas react with one molecule of oxygen to form two molecules of water vapour.
- B one molecule of hydrogen gas reacts with 2 atoms of oxygen to form 1 molecule of water vapour.
- C 2g of hydrogen gas react with 16g of oxygen to form 18g of water.
- D two molecules of hydrogen gas react with 1 molecule of oxygen to form 1 molecule of water.

1.5 The number of atoms in one formula unit of iron(III)sulfate is...

- A 15
- B 10
- C 17
- D 3

1.6 When Mg reacts to become  $\text{Mg}^{2+}$ , the...

- A mass number of Mg decreases
- B mass number of Mg increases
- C number of occupied energy levels decreases
- D charge of the nucleus increases

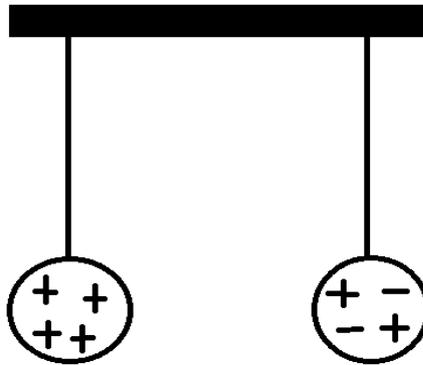
1.7 Reflection of sound is seen as an echo. Which one of the following does NOT use the reflection of sound?

- A. Ultrasound
- B. Bat navigation
- C. Sonar
- D. Tuning fork

1.8 The angle between the lines that connect the geographic north pole and the magnetic north pole is called the angle of...

- A Inclination
- B Declination
- C Polarisation
- D Deviation

1.9 A positively charged sphere is hanging next to a neutral sphere as shown below



The correct sequence of events as they will occur are:

- A Polarisation, attraction, proton transfer and repulsion
  - B Attraction, polarisation, electron transfer and repulsion
  - C Polarisation, electron transfer, attraction and repulsion
  - D Polarisation, attraction, electron transfer and repulsion
- 1.10 How many electrons are in 1 coulomb of charge?
- A  $1,6 \times 10^{-19}$
  - B 1
  - C  $1 \times 1,6 \times 10^{-19}$
  - D  $1 \div 1,6 \times 10^{-19}$

**[2 x 10 = 20]**

## QUESTION 2

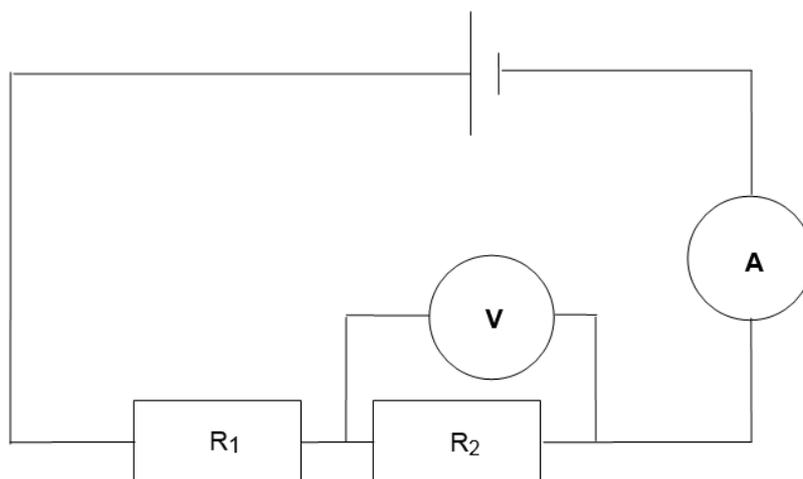
2.1 Define the following terms:

2.1.1 Potential difference

2.1.2 The Ohm

(4)

2.2 Consider the following circuit:



2.2.1 The battery has a potential difference of 12 V. If the ammeter reading is 6A, what is the total resistance of the circuit? (3)

2.2.2 Calculate the resistance of R<sub>1</sub> if the reading on V is 9V. (3)

2.2.3 If the current flows for 2 minutes, what is the amount of charge that flows through R<sub>1</sub> in this time? (4)

2.2.4 How will the ammeter reading change if the two resistors are put in parallel? Only write **Increase, Decrease** or **Stay the same**. (1)

2.2.5 Calculate the total resistance if the resistors are put in parallel. (4)

2.2.6 What is an advantage of having cells in parallel? (1)

2.3.1 A resistor is connected in a circuit with a 9 V battery. Calculate the amount of energy transferred in the resistor if a current of 2 A flows through it in 2 minutes. (4)

2.3.2 To what form(s) of energy will the energy in 2.3.1 be transferred? (1)

[25]

### QUESTION 3

3.1 Represent the dissolution process of the following ionic substances with **balanced** chemical equations (show phases):

3.1.1 potassium permanganate

3.1.2 sodium bromide

3.1.3 potassium nitrate (6)

3.2 Complete/rewrite the following reaction equations in chemical symbol form; if a reaction is possible. **Show all phases and balancing if a reaction is possible.**

3.2.1 silver nitrate + potassium chloride (4)

3.2.2 BaCl<sub>2</sub> + magnesium sulphate (4)

3.2.3 AgCl + NaCl (2)

3.2.4 Zn + Cu<sup>2+</sup> + SO<sub>4</sub><sup>2-</sup> (4)

- 3.4 The approximate pH value ranges of different substances are given in column B. Match these pH values with the acids or bases in column A. Only write the **letter** of the correct item in column B. Column B items may be used more than once.

**Column A**

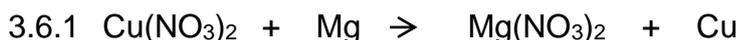
**Column B**

- |                           |           |
|---------------------------|-----------|
| 3.4.1 sulphuric acid      | (a) 1-2   |
| 3.4.2 potassium hydroxide | (b) 3-4   |
| 3.4.3 vinegar             | (c) 5-6   |
| 3.4.4 drain cleaner       | (d) 8-9   |
| 3.4.5 milk                | (e) 10-11 |
|                           | (f) 12-13 |
- (5)

- 3.5 What type of reaction is represented by the following equations? (Choose from Redox, Acid/Base, Precipitation, Gas-forming)



- 3.6 Identify the reduction and oxidation by stating the ionic charge (if any) on the ions or atoms. (Answer as shown in this hypothetical example:  $\text{Ab}^{2+}$  reduced to  $\text{Ab}^{4+}$  and  $\text{Xy}^0$  oxidised to  $\text{Xy}^{1-}$ )



- 3.7.1 What is the name given to the substance that does not undergo any ionic change during a redox reaction? (1)

- 3.7.2 Give the chemical test that should be performed in order to test for the presence of carbon dioxide. (2)

**[35]**

#### **QUESTION 4**

- 4.1.1 Define the term allotrope. (2)
- 4.1.2 Give an example of two substances that are allotropes of each other. (1)
- 4.1.3 What type of structure does these two allotropes have? (1)

4.2 Iron(III)chloride is formed when iron burns in chlorine gas. The iron is heated to start the reaction and then the source of the heat is removed. Iron burns vigorously in chlorine gas.

Study the table below and answer the following questions:

	<b>Iron</b>	<b>Chlorine</b>	<b>Iron(III)chloride</b>
<b>Chemical formula</b>	Fe	Cl <sub>2</sub>	4.2.1.1
<b>State at room temperature</b>	solid	4.2.1.2	4.2.1.3
<b>Colour</b>	Shiny grey	Yellow-green	Red-brown
<b>Melting point</b>	Above 1000°C	-103°C	Above 1000°C
<b>Boiling point</b>	Above 1000°C	-34°C	Above 1000°C
<b>Does it conduct electric current at room temperature?</b>	4.2.1.4	No	No

- 4.2.1 Give the missing words for 4.2.1.1, 4.2.1.2, 4.2.1.3 and 4.2.1.4 (4 x 1)
- 4.2.2 Under which two conditions will iron(III)chloride conduct electricity? (2)
- 4.2.3 Explain why iron(III)chloride will not conduct electricity at room temperature, but will conduct electricity under the conditions in 4.2.2. (4)

**[14]**

#### **QUESTION 5**

- 5.1.1 Define boiling point. (3)
- 5.1.2 Explain why water boils at a lower temperature at the summit of a mountain than at its foot. (3)
- 5.1.3 Will the water in a pressure cooker boil at a higher temperature, a lower temperature or the same temperature than the water in a normal pot? Give a reason for your answer. (3)
- 5.1.4 Boiling and evaporation are both processes by which a substance changes from a liquid phase to a gaseous phase. Give two differences between evaporation and boiling. (2)

- 5.2 State whether the following is a physical or a chemical change and give a reason for your answer.
- 5.2.1 dissolving sodium chloride in water (2)
- 5.2.2 boiling an egg (2)
- 5.3 The law of constant proportion states that, in any particular chemical compound, all samples of the compound will be made up of the same elements in the same proportion or ratio. State the ratio of the atoms in ammonium nitrate. (4)

**[19]**

### **QUESTION 6**

- 6.1 Write the following word equation as a balanced chemical equation.  
potassium hydroxide + sulfuric acid  $\rightarrow$  potassium sulphate + water (4)
- 6.2 Use the law of conservation of mass to prove that the balancing in your answer for 6.1 is correct. (5)

**[9]**

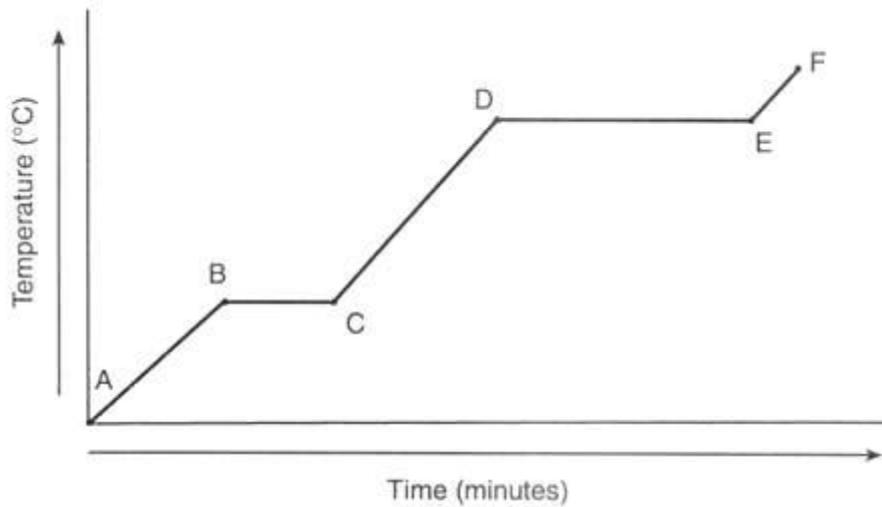
### **QUESTION 7**

- 7.1 Consider the compound  $\text{CaCl}_2$ .
- 7.1.1 Draw the aufbau diagram for a chloride-ion. (3)
- 7.1.2 Give the sp-notation for the calcium-ion. (2)
- 7.1.3 What type of chemical bond exists in the formation of  $\text{CaCl}_2$ ? (1)
- 7.2 Consider the compound  $\text{CO}_2$  :
- 7.2.1 What type of chemical bond exists in the formation of  $\text{CO}_2$ ? (1)
- 7.2.2 Explain your answer by using Lewis notation to show the formation of  $\text{CO}_2$ . (3)

**[10]**

## QUESTION 8

Consider this heating curve of water and answer the questions:



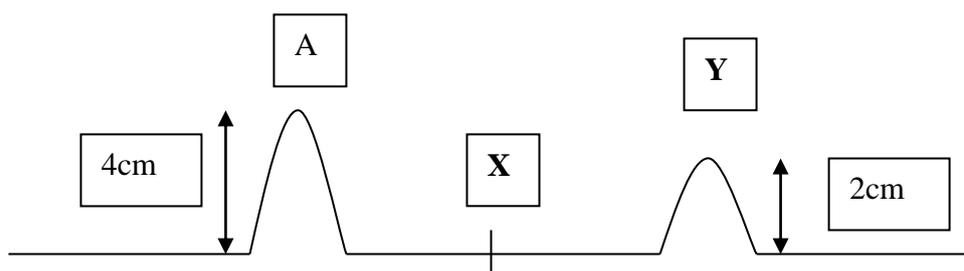
At 1 atm pressure:

- 8.1 What is the temperature at B? (1)
- 8.2 What is the temperature at D? (1)
- 8.3 What is the process between B and C called? (1)
- 8.4 What is the **lost heat** between B and C called? (1)
- 8.5 What is the **lost heat** between D and E called? (1)
- 8.6 Explain, in terms of the Kinetic Molecular Theory, why the temperature stays constant between D and E even though heat is still applied. (3)

[8]

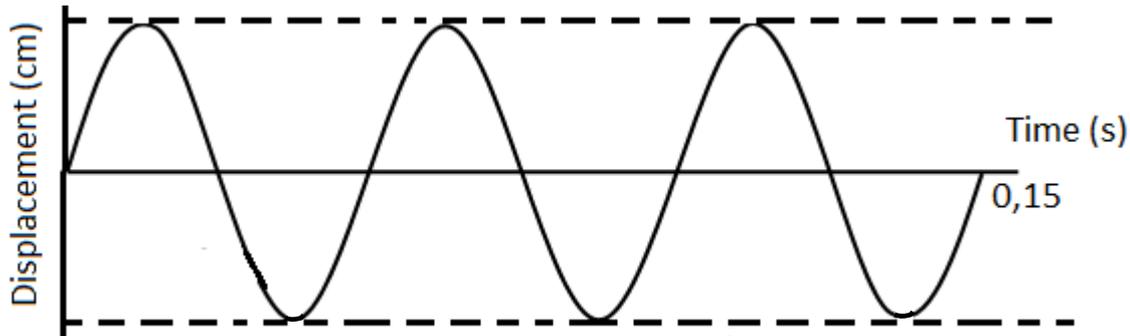
## QUESTION 9

- 9.1 Two pulses A and B move toward each other at the same speed. The amplitudes are 4cm and 2cm respectively. Pulses meet each other at point X.



- 9.1.1 Define a **pulse**. (2)
- 9.1.2 What is the name given to the type of interference that occurs at point X? (1)
- 9.1.3 What is the amplitude of the resultant pulse (in cm)? (1)
- 9.2.1 Define a transverse wave. (2)

- 9.3 A transverse wave moves along a rope. A graph of displacement versus time for the wave is shown below. The vertical distance between crest and trough is 2,4cm.

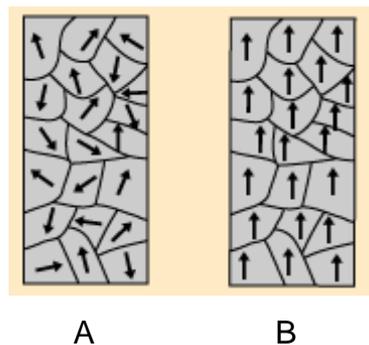


- 9.3.1 How many completed waves are there between  $t = 0$  and  $t = 0,15\text{s}$ ? (1)
- 9.3.2 From the given information, write down the amplitude of the wave. (2)
- 9.3.3 Calculate the period of the wave. (2)
- 9.3.4 Calculate the frequency. (2)
- 9.3.5 If the wavelength of the wave is 0,2m, calculate the speed of the wave. (3)
- 9.4 Is sound a longitudinal or a transverse wave? (1)
- 9.5 A man stands between two high cliffs. He finds that when he claps his hands he hears the echo from the one cliff within 3s and the echo from the other cliff after 5s. Calculate the distance between the two cliffs if the speed of sound is  $343 \text{ m}\cdot\text{s}^{-1}$ . (6)

[23]

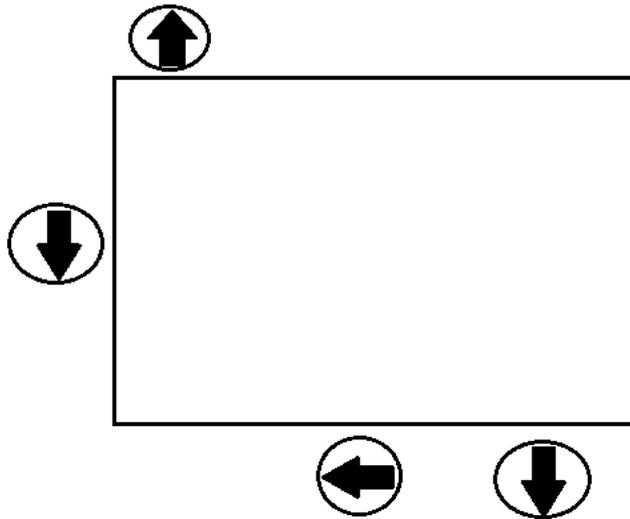
### QUESTION 10

The diagrams below show samples of a ferromagnetic material (eg. Iron). The one diagram shows the magnetised material and the other shows the demagnetised material.



- 10.1.1 What name is given to the outlined areas (each with an arrow) in the diagrams? (1)
- 10.1.2 Which diagram (a or b) represents the magnetised material? (1)
- 10.1.3 Give a reason for your answer. (2)

10.2 TWO bar magnets are inside a closed container. Use the information in these sketches to show how the magnets are placed inside the container (redraw the sketch and then complete).



(4)  
[8]

**QUESTION 11**

11.1.1 What is meant by “electromagnetic radiation has a Wave-Particle Duality”? (2)

11.1.2 Arrange the following forms of electromagnetic radiation in order of decreasing WAVELENGTH:

- Gamma Rays ( $>10^{20}$  Hz),**
- Ultraviolet light ( $10^{15} - 10^{17}$  Hz),**
- Infrared light ( $10^{11} - 10^{14}$  Hz),**
- Visible light ( $10^{14} - 10^{15}$  Hz).** (2)

11.1.3 Electromagnetic waves with a wavelength of 1,45nm are emitted. Calculate the frequency of these waves. (3)

11.1.4 Considering 11.1.2, and based on your answer in 11.1.3, what type of electromagnetic radiation was being emitted? (1)

11.1.5 Name the type of electromagnetic radiation that:

- (a) has the shortest wavelength. (1)
- (b) can cause skin cancers. (1)
- (c) is used to send signals from the remote control to the TV. (1)

11.2.1 What is a photon? (2)

11.2.2 Photons of an electromagnetic wave have energy  $2,35 \times 10^{-18}$  J.

(a) Calculate the frequency of the wave. (3)

(b) Calculate the wavelength of the wave. (3)

**[19]**

**QUESTION 12**

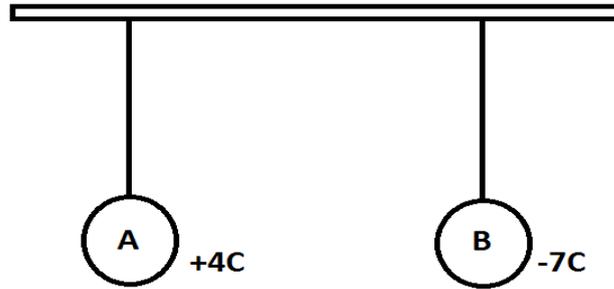
12.1 Use the tribo-electric series given below to determine which of the following objects in each pair will be more 'positive' or 'negative' in relation to one another when the rod is rubbed with the cloth:

Very positive	Air
	Rabbit fur
	Perspex
	Glass
	Human hair
	Nylon
	Wool
	Fur
	Silk
Slightly positive	Aluminium
Neutral	Cotton
Slightly negative	Copper
	Silver
	Gold
	Polyester
	PVC
Very negative	Teflon

12.1.1 A PVC rod rubbed with a polyester cloth. (2)

12.1.2 A glass rod rubbed with a silk cloth. (2)

12.2 Two charged polystyrene balls (A and B), with charges  $+4C$  (A) and  $-7C$  (B) respectively, touch each other and are then removed from each other. Answer the following:



12.2.1 Draw a sketch showing a negatively charged polystyrene ball. (2)

12.2.1 Did the electrons move from (A to B) or (B to A)? (1)

12.2.2 Calculate the new charge on each ball? (3)

**[10]**