



ALEXANDER ROAD HIGH SCHOOL

JUNE 2015

2,5 HOURS

PHYSICAL SCIENCE

KB, MH, CO

TOTAL = 150

GRADE 10

Instructions

- The question paper consists of 10 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.
 - Some relevant formulas and important constants can be found at the end of the question paper.
 - A periodic table can be found at the back of the answer sheet.
 - Round off to two (2) decimal places unless otherwise stated.
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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 make a cross (X) in the block (A – D) next to the question number (1.1 – 1.10) on the attached ANSWER SHEET.

1.1 Study the equation below:



Which *one* of the statements below are correct?

- A one molecule of methane gas reacts with two atoms of oxygen to form two molecules of water vapour and one molecule of carbon dioxide gas.
- B one molecule of methane gas reacts with 4 atoms of oxygen to form 1 mole of carbon dioxide and 2 moles of water vapour.
- C one mole of methane gas reacts with two moles of oxygen gas to form 1 mole of carbon dioxide and 2 moles of water vapour.
- D 16 g of methane gas reacts with 16 g of oxygen to form 44g of carbon dioxide and 36g of water vapour.

- 1.2 The number of atoms in one formula unit of iron(III)nitrate is...
- A 13
 - B 10
 - C 14
 - D 3
- 1.3 When an atom X of an element in Group 2 reacts to become X^{2+} , the...
- A mass number of X increases
 - B atomic number of X decreases
 - C number of occupied energy levels decreases
 - D charge of the nucleus increases
- 1.4 The distance between 7 consecutive crests is 420mm. What is the wavelength of the wave in metres?
- A. 0,07m
 - B. 0,42m
 - C. 0,06m
 - D. 0,7m
- 1.5 Which of the following types of Electromagnetic Radiation is seen as *Ionising Radiation*
- A. Infrared
 - B. Gamma Rays
 - C. Microwave
 - D. Visible
- 1.6 Which type of electromagnetic radiation has the highest frequency?
- A. Infrared
 - B. Ultraviolet
 - C. X Rays
 - D. Visible light
- 1.7 The following statement is true regarding potential difference (voltage) and current strength:
- A resistors in parallel cause current to stay the same and voltage to divide
 - B resistors in series cause current and voltage to divide
 - C resistors in parallel cause current and voltage to stay the same
 - D resistors in parallel cause current to divide and voltage to stay the same

1.8 In which sketch is the resultant (R) correctly indicated? (sketches are not to scale)



1.9 The resultant displacement can be calculated from a graph by calculating the:

- A the gradient of the acceleration-time graph
- B the area under the acceleration-time graph
- C the area under the velocity-time graph
- D the gradient of the velocity-time graph

1.10 The approximate bearing for the following vector (F) is:

- A 45°
- B 220°
- C 135°
- D 300°



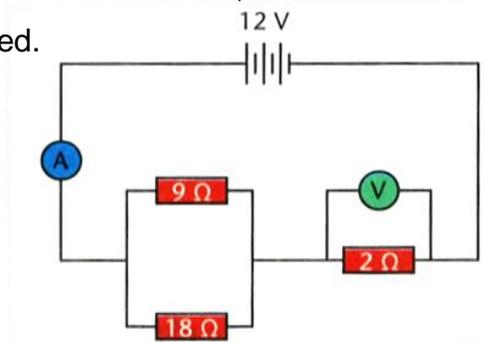
[2 X 10 = 20]

SECTION B

- Answer all questions on the folio pages provided -

QUESTION 2:

Consider the circuit with three resistors ($9\ \Omega$ and $18\ \Omega$ in parallel and a $2\ \Omega$ in series), a voltmeter and an ammeter, in the main circuit, are connected. The resistance of the wires and the $12\ \text{V}$ battery can be ignored.



- 2.1 Calculate the total resistance of the circuit. (3)
- 2.2 Calculate the ammeter reading. (3)
- 2.3 Calculate the voltmeter reading. (3)

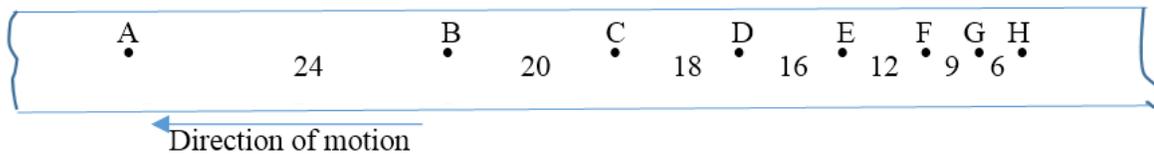
[9]

QUESTION 3:

- 3.1.1 Define what a vector is. (2)
- 3.1.2 Define what a resultant is. (2)

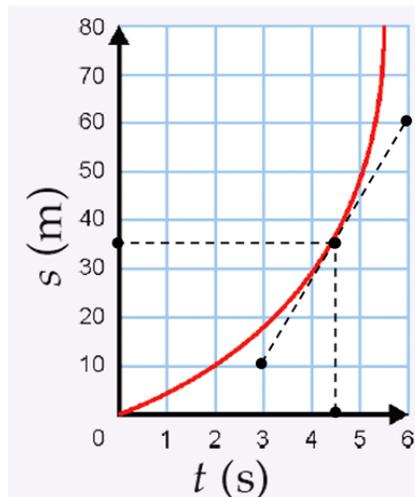
3.2 A boy walks to the shop from his house. He walks 70 meters north, then 80 m east, then 50 meters north and lastly 50m west. He then reaches the shop. Determine his resultant displacement by **accurate scale drawing** (use a scale of 1cm : 10 m) (5)

3.3 A ticker tape, produced by an accelerating or decelerating trolley, is given with measurements indicated for you. The frequency of the ticker timer is 50 Hz. The measurements (in mm) were given for groups of **20 intervals (21 dots)**, and the direction of motion is indicated.



- 3.3.1 Was this trolley accelerating or decelerating? (1)
- 3.3.2 Define acceleration. (2)
- 3.3.3 Study this ticker tape carefully and calculate the average velocity of this trolley from A to C by using all the data and information given. (4)
- 3.3.4 If the average velocity from F to H is given as $0,01875 \text{ m}\cdot\text{s}^{-1}$, calculate the acceleration of the trolley. (4)

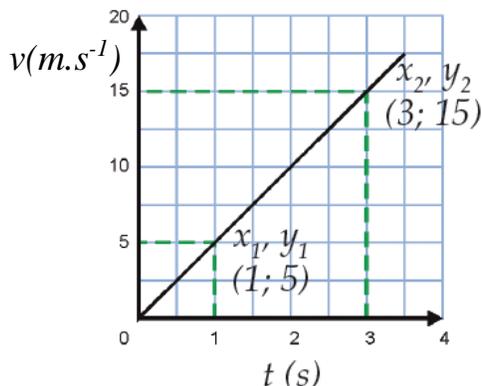
3.4 Consider the given graph:



- 3.4.1 Calculate the instantaneous velocity of the motion at 4,5 seconds. Use the information from the graph. (3)

3.4.2 Draw a rough velocity time graph for this motion. You do not have to indicate any velocity or time values. (2)

3.5 Consider the following velocity vs. time graph:



3.5.1 Use the graph and calculate the displacement of the object from 1 – 3 seconds. (3)

3.5.2 Also calculate the acceleration from the graph. (2)

3.6 A car accelerates from a point X at $10 m.s^{-2}$ over a distance of 45 m and reaches a velocity of $50 m.s^{-1}$. Use equations of motion and calculate the velocity of the car as it passed point X. (4)

[34]

QUESTION 4

4.1 Define the term allotrope. (2)

4.2 Which type of bond keeps the atoms of a diamond together? (1)

4.3 What type of structure does graphite have? (1)

4.4 How does the structure of graphite enable the substance to conduct electricity? (4)

4.5 Explain why salt does not conduct electricity as a solid, but does conduct electricity in a solution or in molten form. (4)

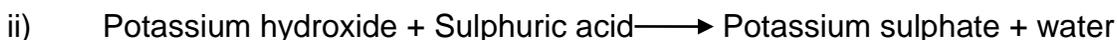
[12]

QUESTION 5

- 5.1 Explain why water boils at a lower temperature in Johannesburg than in Port Elizabeth. (3)
- 5.2 Mass is conserved during both physical and chemical changes. What is conserved during physical change, but not during chemical change? (1)
- 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 calcium nitrate. (4)
- 5.4 Name the physical change when a gas changes directly into a solid. (1)
- [9]**
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QUESTION 6

Consider the following equations



- 6.1 Rewrite and balance equation i) (4)
- 6.2 Use the law of conservation of mass to prove that the balancing in 6.1 is correct. (5)
- 6.3 Rewrite ii) as a reaction equation and then balance the equation.
Indicate the phases of all the substances. (5)

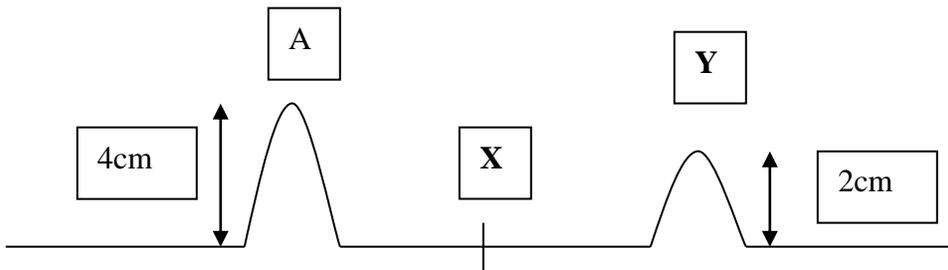
[14]

QUESTION 7

- 7.1 Draw the Aufbau diagram for an oxygen-ion. (3)
- 7.2 Give the sp-notation for the ion in 7.1. (2)
- 7.3 Draw a Lewis diagram to show the formation of CaCl_2 . (4)
- [9]**
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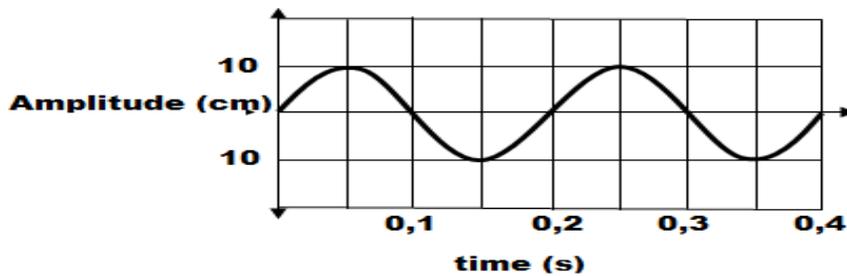
QUESTION 8

8.1 Look at the diagram below.



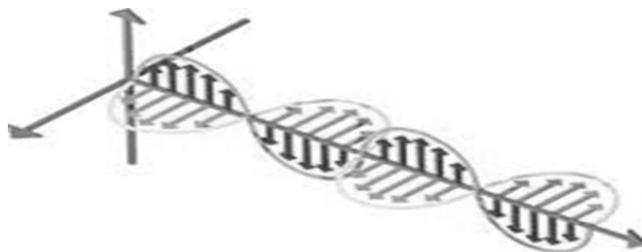
- a) Name the type of interference at point X (1)
- b) Indicate the height of the resultant pulse at X. (2)

8.2 The figure below shows the displacement in a medium after a disturbance has passed through the medium at $5\text{m}\cdot\text{s}^{-1}$.



Using this information:

- 8.2.1 What is the period of the wave? (2)
- 8.2.2 Calculate the frequency of the wave. (2)
- 8.2.3 Calculate the wavelength of the wave (3)
- 8.3.1 Electromagnetic radiation has a wave-particle duality. What does this mean? (2)
- 8.3.2 With the aid of the diagram below, explain how an electromagnetic wave propagates. (3)



8.3.3 Arrange the following types of Electromagnetic radiation in order of **increasing** wavelength:

Infrared, gamma rays, visible, X-rays (2)

8.4 Give the definition of a **photon**. (1)

8.5 Orange light, found in the visible spectrum, has a relatively long wavelength when compared to the other colours of the visible spectrum. Orange light also has a frequency of $5,0 \times 10^{14}$ Hz. Using this information...

8.5.1 Calculate the **wavelength** of orange light. (3)

8.5.2 Determine the **energy** of orange light. (3)

8.6. Two students were creating a hypothesis for an experiment to determine how the energy of certain types of electromagnetic radiation relates to their penetrating ability. The students' hypotheses were as follows...

Student 1: The higher the frequency of the electromagnetic radiation, the higher the energy and the higher the penetrating ability

Student 2: The higher the frequency of the electromagnetic radiation, the lower the energy and the lower the penetrating ability.

8.6.1 Which student has the correct hypothesis? (**Student 1, Student 2 or Neither**) (2)

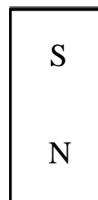
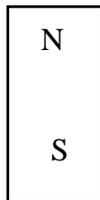
[26]

QUESTION 9

9.1 Fill in the missing words in these sentences:

- A **(9.1.1)** is a region in which the magnetic fields of atoms are grouped together and aligned (1)
- Like poles in magnets **(9.1.2)** each other. (1)
- The region in which the magnetic fields of atoms are grouped together and aligned is called **(9.1.3)** (1)

9.2 Copy the following diagram and draw the combined magnetic field around the following magnets



(3)

[6]

QUESTION 10

10.1 Use the tribo-electric series given below to determine which of the following objects in each pair will be more 'positive' and '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

10.1.1 A silver rod rubbed with a polyester cloth. (2)

10.1.2 A perspex rod rubbed with a silk cloth. (2)

10.2 If two charged polystyrene balls (A and B), with charges $4C$ (A) and $-6C$ (B) respectively, touch each other and then are removed from each other. Answer the following;

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

10.2.2 What will be the new charge on each ball? (3)

10.3 After two spheres touch, each sphere obtains a charge of $+6C$. Calculate the charge on the second sphere, if the first sphere has a charge of $-4C$. (3)

[11]

TOTAL = 150