



education

Department of
Education
FREE STATE PROVINCE

EXAMINATION

GRADE 10

PHYSICAL SCIENCES

JUNE 2019

MARKS: 150

TIME: 3 HOURS

This paper consists of 15 pages and two information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of NINE questions. Answer ALL questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

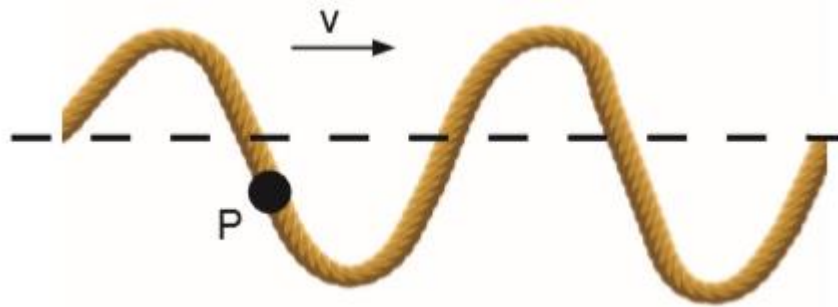
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write down only the letter A, B, C or D next to the question number (1.1-1.10) in your ANSWER BOOK.

- 1.1 Which one of the following is NOT a property of metals?
- A Brittle
 - B Malleable
 - C Shiny
 - D Generally denser than ice. (2)
- 1.2 What do we call the movement of atoms or molecules from an area of higher concentration to an area of lower concentration?
- A Brownian motion
 - B Sublimation
 - C Diffusion
 - D Dilution (2)
- 1.3 Which one of the following scientists was responsible for the discovery of the neutron?
- A Thompson
 - B Bohr
 - C Dalton
 - D Chadwick (2)
- 1.4 Which one of the following is true for elements in GROUP TWO on the periodic table?
- A The chemical reactivity increase from top to bottom.
 - B The chemical reactivity increase from bottom to top.
 - C Number of energy levels stays the same down the group.
 - D Number of energy levels increase from bottom to top. (2)

- 1.5 In which one of the following substances do we find COVALENT BONDS between the particles?
- A Helium
 - B Aluminium
 - C Chlorine
 - D Table salt (2)
- 1.6 What are the elements in GROUP TWO called?
- A Noble gases
 - B Halogens
 - C Earth-alkaline metals
 - D Alkali metals (2)
- 1.7 The electron distribution in the LEWIS STRUCTURE of sulphur is the same as that of ...
- A chlorine.
 - B oxygen.
 - C aluminium.
 - D germanium. (2)
- 1.8 Which one of the following is an example of a longitudinal wave?
- A A Mexican wave
 - B A note played on a violin.
 - C Waves on water
 - D Light waves (2)

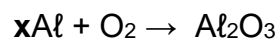
1.9 The diagram below shows a transverse wave in a rope moving to the RIGHT.



In which direction does point **P** move at the instant shown above?

- A Left
- B Right
- C Up (to the top of the page)
- D Down (to the bottom of the page) (2)

1.10 What value must **x** have to balance the following chemical equation?



- A 1
 - B 2
 - C 3
 - D 4 (2)
- [20]**

QUESTION 2

The table below shows the phases and solubility of some substances in water at room temperature, which is about 22°C.

Substance	General name	Phase at room temperature	Soluble in water?
Si	Silicon	Solid	No
H ₂ O	Water	Liquid	Yes
Al	Aluminium	Solid	No
Ne	Neon	Gas	No
NaCl	Table salt	Solid	Yes

2.1 Define the following:

2.1.1 An element (2)

2.1.2 A homogeneous mixture (2)

2.2 Which of these substances will form a homogeneous mixture when they are mixed? (2)

2.3 Explain why all the substances in the table are pure substances. (2)

2.4 Write down the chemical name for the compound NaCl. (1)

2.5 Write down the name or formula of the following from the table:

2.5.1 A metalloid (2)

2.5.2 Any substance that can conduct electricity. (2)

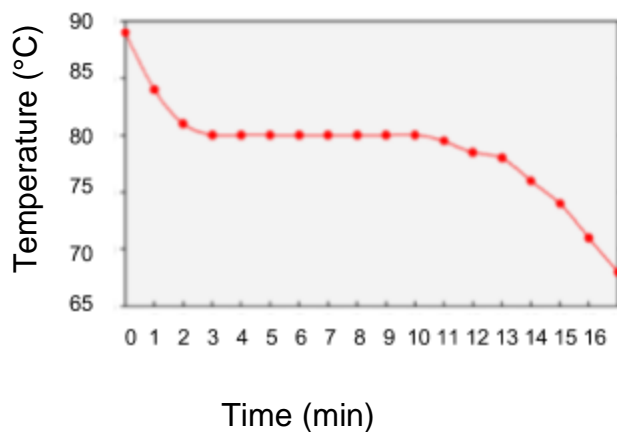
2.5.3 The substance in which the greatest distances between its particles occur at room temperature. (2)

2.5.4 A substance that has a melting point below room temperature and a boiling point above room temperature. (2)

[17]

QUESTION 3

A graph of the change in temperature versus the change in time for naphthalene is shown below. The boiling point of naphthalene is 218°C .



- 3.1 Define *freezing point*. (2)
 - 3.2 Determine the freezing point of naphthalene from the graph if naphthalene is a solid at 75°C . (2)
 - 3.3 How did you determine your answer to question 3.2? (2)
 - 3.4 In what phase is naphthalene during the last three minutes of the experiment? (2)
- [8]**

QUESTION 4

- 4.1 Use the attached periodic table to answer the following questions. Write down only the SYMBOLS to answer the questions.
 - 4.1.1 A non-metal in group 1 (1)
 - 4.1.2 The element with the smallest atomic radius (1)
 - 4.1.3 An inert gas in the third period (1)
 - 4.1.4 A gas with six valence electrons (1)
 - 4.1.5 A halogen in period two (1)
 - 4.1.6 The element that has same number of electrons as a chlorine ion (Cl^-) (1)

- 4.2 Refer to SODIUM (Na) in the periodic table to answer the following questions:
- 4.2.1 Write down the atomic number of sodium. (1)
- 4.2.2 Calculate the number of neutrons in one sodium atom. (2)
- 4.2.3 Use the sp-notation to write down the electron configuration of one sodium atom. (2)
- 4.2.4 Which one of sodium or lithium has the largest atomic radius? Refer to energy levels to explain your answer. (2)
- 4.2.5 Define the term *isotope*. (2)
- 4.2.6 Sodium occurs naturally as sodium-22 and sodium-23. Use the A_ZX notation to represent these two isotopes of sodium. (3)
- 4.3 Calculate the relative atomic mass of silver if it is known that ${}^{107}_{47}\text{Ag}$ has a 51,8% occurrence in nature and ${}^{109}_{47}\text{Ag}$ has a 48,2% occurrence. (4)
- [22]**

QUESTION 5

- 5.1 The first ionisation energy of phosphorus is equal to 1 012 kJ·mol⁻¹.
- 5.1.1 Define the term *ionization energy*. (2)
- 5.1.2 Do you expect the first ionisation energy of NITROGEN to be LESS THAN, the SAME AS or GREATER THAN 1 012 kJ·mol⁻¹? (2)
- 5.1.3 Draw the Aufbau diagram for phosphorus. (3)
- 5.2 Give the chemical name for:
- 5.2.1 NH₄OH (2)
- 5.2.2 Al₂O₃ (2)
- 5.3 Write down the formula of the CATION in calcium nitrate. (2)
- 5.4 Give the chemical formula for:
- 5.4.1 Calcium nitrate (2)
- 5.4.2 Nitrogen gas (2)

- 5.5 A piece of magnesium ribbon is burned in oxygen gas. Magnesium oxide, a white powder is formed.

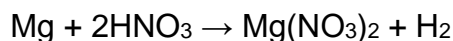
5.5.1 Write down the name of the chemical bond found in:

- (i) Magnesium ribbon (1)
- (ii) Magnesium oxide (1)

5.5.2 Is the reaction an example of a chemical or physical change?
Give a reason for your answer. (2)

5.5.3 Write down a balanced equation for the reaction. (3)

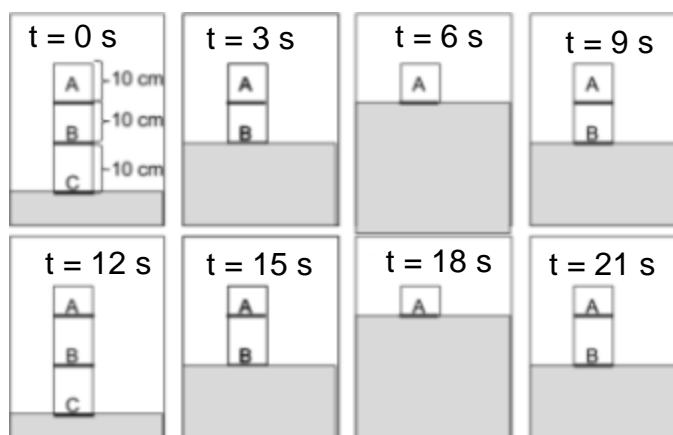
- 5.6 Consider the following balanced chemical reaction:



Calculate the relative atomic mass of the REAGENTS and the PRODUCTS and prove that mass is conserved. (4)
[28]

QUESTION 6

- 6.1 A vertical pole with three marks, **A**, **B** and **C**, stands in water and a wave flushes past the points on the pole. The sketches below represent a series of photographs taken every THREE seconds.

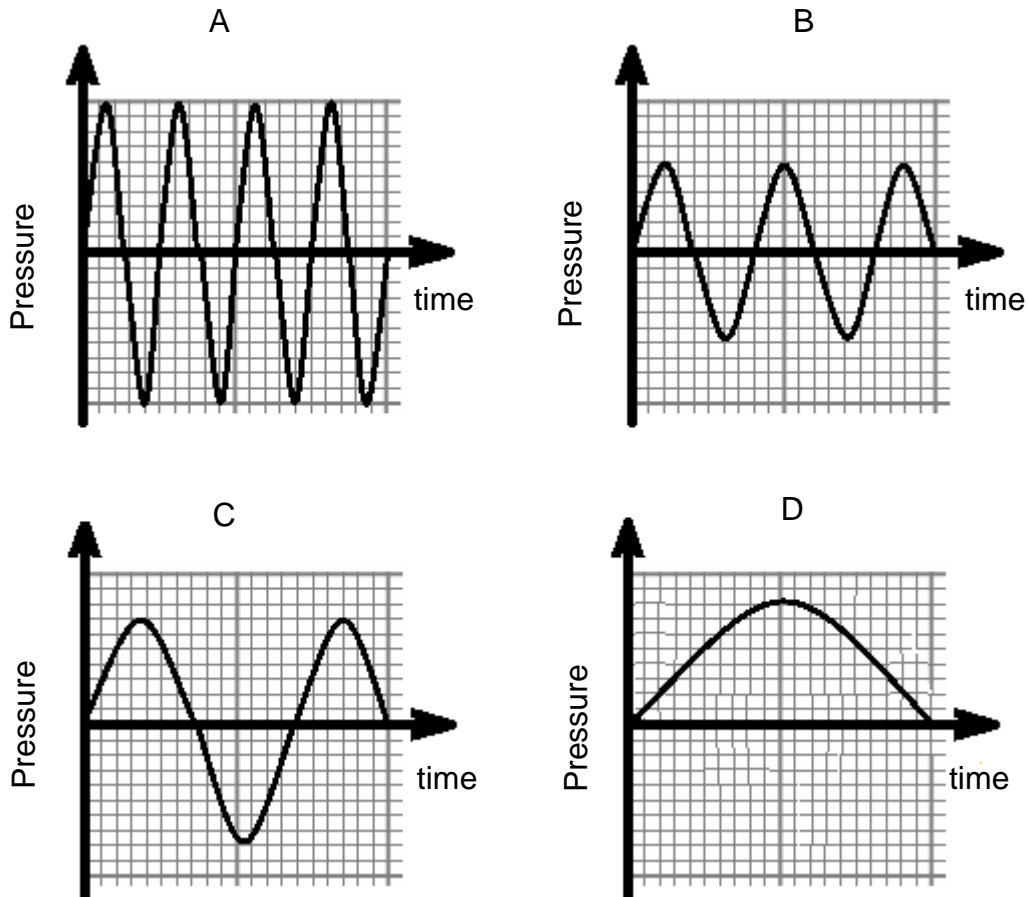


- 6.1.1 Are water waves longitudinal or transverse? (1)
- 6.1.2 Motivate your answer to question 6.1.1 with a brief explanation. (2)
- 6.1.3 What is the magnitude of the amplitude of the wave? (2)
- 6.1.4 What is the magnitude of the period of the wave? (2)

6.1.5 Calculate the frequency of the wave. (3)

6.1.6 Calculate the wavelength of the wave if it has a speed of $2 \text{ m}\cdot\text{s}^{-1}$. (3)

6.2 The graphs **A**, **B**, **C** and **D** below shows the relationship between pressure and time for sound waves.



Answer the following questions by writing down ONLY THE LETTER that represents the sound wave with the:

6.2.1 Highest frequency (2)

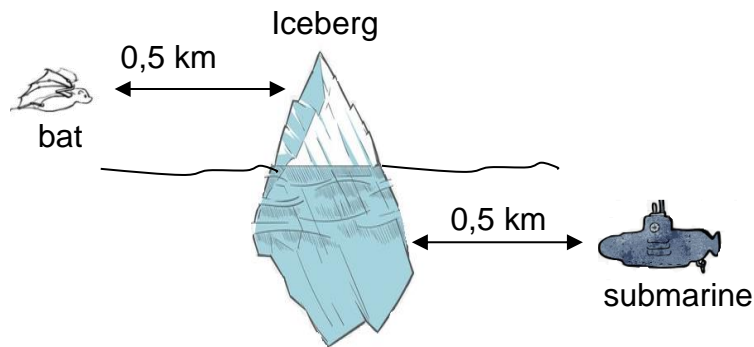
6.2.2 Longest wavelength (2)

6.2.3 Loudest note (1)

6.2.4 Smallest amplitude (1)

6.2.5 Lowest pitch (1)

- 6.3 A submarine is 0,5 km from an iceberg and at the same instant a bat is also 0,5 km from the iceberg as shown below.



- 6.3.1 Explain how both the bat and the submarine use sound to determine how far away they are from the iceberg. (3)

- 6.3.2 Both the bat and the submarine release sound simultaneously. Which sound reached the iceberg first? (1)

- 6.3.3 Give a reason for your answer to question 6.3.2. (2)
[26]

QUESTION 7

- 7.1 Examples of electromagnetic waves are given below

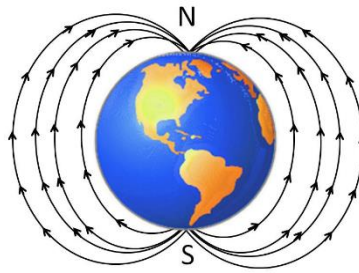
UV rays	infrared	radio waves
X-rays	gamma rays	microwaves

Choose the electromagnetic wave which best fits the description below:

- 7.1.1 Used in TV remote controls. (1)
- 7.1.2 Used in hospitals to sterilise instruments. (1)
- 7.1.3 Used for the radiation treatment of cancer. (1)
- 7.1.4 Used for TV broadcasting. (1)
- 7.2 Calculate the energy of a photon if it has a wavelength of $2,1 \times 10^{-9} \text{ m}$. (4)
- 7.3 Write down TWO properties of electromagnetic waves. (2)
[10]

QUESTION 8

The earth acts just like a very large magnet and creates a magnetic field



- 8.1 Explain how the magnetic field around the earth can be used to determine direction on earth. (2)
- 8.2 Explain the difference between geographic north and the earth's magnetic north pole. (2)
- 8.3 Why can the magnetosphere be regarded as a protective layer around the earth? (1)
- 8.4 Write down the name of a spectacular north pole phenomenon due to the protection provided by the magnetosphere. (1)

[6]

QUESTION 9

A NEUTRAL plastic ball, **N**, is suspended from an insulating string. An identical ball, **P**, is attached to a similar string and ball **P** has a charge of $+9 \times 10^{-9} \text{ C}$.



- 9.1 Are there any charged particles on ball **N**? Answer either YES or NO and explain your answer. (2)
- 9.2 Calculate the number of electrons that were removed from **P** to give it the positive charge. (3)
- 9.3 Ball **P** is brought closer and closer to **N** until a visible effect is observed in the case of ball **N**. What happens to **N**? (1)
- 9.4 Ball **P** is allowed to TOUCH ball **N** and then TAKEN AWAY from **N**.
- 9.4.1 Describe the movement of the charged particles when **P** and **N** are in contact. Refer to the type of charge and the direction in which they move. (2)
- 9.4.2 Calculate the charge on ball **N** after it has touched **P** and was separated again. (3)
- 9.5 Ball **P** is once again brought closer and closer to **N** until a visible effect is observed for ball **N**.
- 9.5.1 What happens to ball **N** this time? (1)
- 9.5.2 Explain your answer to question 9.5.1. (1)
- [13]**

GRAND TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 10
GEGEWENS VIR FISIIESE WETENSKAPPE GRAAD 10

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIIESE KONSTANTES

NAME / NAAM	SYMBOL / SIMBOOL	VALUE / WAARDE
Speed of light in a vacuum Spoed van lig in 'n vakuum	c	$3,0 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
Planck's constant Planck se konstante	h	$6,63 \times 10^{-34} \text{ J}\cdot\text{s}$
Charge on electron Lading op elektron	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass Elektronmassa	m_e	$9,11 \times 10^{-31} \text{ kg}$

TABLE 2: FORMULAE / TABEL 2: FORMULES

WAVES, SOUND AND LIGHT / GOLWE, KLANK EN LIG

$v = \lambda f$	$E = hf = h \frac{c}{\lambda}$
$Speed = \frac{distance}{time}$ $Spoed = \frac{afstand}{tyd}$	$T = \frac{1}{f} \text{ OR/OF } f = \frac{1}{T}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)																												
<div><div>KEY/SLEUTEL</div><div><div>Atomic number <i>Atoomgetal</i></div><div>Electronegativity <i>Elektronegatiwiteit</i></div><div>Symbol <i>Simbool</i></div><div>Approximate relative atomic mass <i>Benaderde relatiewe atoommassa</i></div></div><div><div>29 Cu 63,5</div></div></div>																																													
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0,9 11 Na 23	1,2 12 Mg 24											13 Al 27	14 Si 28	15 P 31	16 S 32	17 Cl 35,5	18 Ar 40																												
0,8 19 K 39	1,0 20 Ca 40	1,3 21 Sc 45	1,5 22 Ti 48	1,6 23 V 51	1,6 24 Cr 52	1,5 25 Mn 55	1,8 26 Fe 56	1,8 27 Co 59	1,8 28 Ni 59	1,9 29 Cu 63,5	1,6 30 Zn 65	1,6 31 Ga 70	1,8 32 Ge 73	2,0 33 As 75	2,4 34 Se 79	2,8 35 Br 80	36 Kr 84																												
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91		41 Nb 92	1,8 42 Mo 96	1,9 43 Tc 98	2,2 44 Ru 101	2,2 45 Rh 103	2,2 46 Pd 106	1,9 47 Ag 108	1,7 48 Cd 112	1,7 49 In 115	1,8 50 Sn 119	1,9 51 Sb 122	2,1 52 Te 128	2,5 53 I 127	54 Xe 131																											
0,7 55 Cs 133	0,9 56 Ba 137		1,6 72 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1,8 81 Tl 204	1,8 82 Pb 207	1,9 83 Bi 209	2,0 84 Po	2,5 85 At	86 Rn																												
0,7 87 Fr	0,9 88 Ra 226	89 Ac																																											
<table><tr><td>58 Ce 140</td><td>59 Pr 141</td><td>60 Nd 144</td><td>61 Pm</td><td>62 Sm 150</td><td>63 Eu 152</td><td>64 Gd 157</td><td>65 Tb 159</td><td>66 Dy 163</td><td>67 Ho 165</td><td>68 Er 167</td><td>69 Tm 169</td><td>70 Yb 173</td><td>71 Lu 175</td></tr><tr><td>90 Th 232</td><td>91 Pa</td><td>92 U 238</td><td>93 Np</td><td>94 Pu</td><td>95 Am</td><td>96 Cm</td><td>97 Bk</td><td>98 Cf</td><td>99 Es</td><td>100 Fm</td><td>101 Md</td><td>102 No</td><td>103 Lr</td></tr></table>																		58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175	90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr
58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175																																
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr																																