



education

Department of
Education
FREE STATE PROVINCE

PROVINCIAL CONTROL TEST

GRADE 10

PHYSICAL SCIENCES

MARCH 2017

MARKS: 100

TIME: 2 HOURS

This paper consists of EIGHT pages and TWO information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and grade on the ANSWER BOOK.
2. This question paper consists of SEVEN (7) questions. Answer ALL the 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 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 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.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

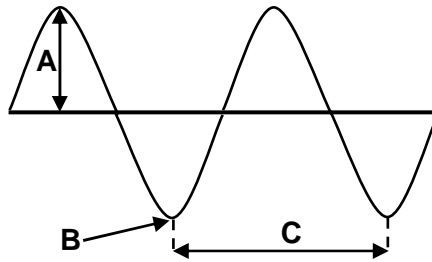
QUESTION 1: MULTIPLE CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has ONE correct answer only. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E

- 1.1 A pure substance can be ...
- A a homogeneous mixture.
 - B a compound only.
 - C an element only.
 - D an element or a compound. (2)
- 1.2 Which ONE of the following is an example of a heterogeneous mixture?
- A Distilled water
 - B Concrete
 - C Salt water
 - D Ice (2)

- 1.3 The formula NO_2^- represents a:
- A Nitride ion
 - B Nitrite ion
 - C Molecule
 - D Nitrate ion (2)
- 1.4 Which ONE of the following symbols represents an isotope of fluorine-19?
- A ${}_{19}^9\text{X}$
 - B ${}_{10}^{19}\text{X}$
 - C ${}_{11}^{20}\text{X}$
 - D ${}_{9}^{20}\text{X}$ (2)
- 1.5 Which ONE of the following electron configurations represents an element that can form an ion with a - 3 charge?
- A $1s^2 2s^2 2p^6 3s^2 3p^1$
 - B $1s^2 2s^2 2p^6 3s^2 3p^3$
 - C $1s^2 2s^2 2p^6 3s^2 3p^4$
 - D $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ (2)
- 1.6 The measure of the tendency of an atom in a molecule to attract bonding electrons is ...
- A electron affinity.
 - B ionic bonding.
 - C electronegativity.
 - D metallic bonding. (2)
- 1.7 When a water wave moves from deep to shallow water, its ...
- A frequency decreases.
 - B speed stays constant.
 - C wavelength decreases.
 - D speed increases. (2)

1.8 The diagram below represents a section of a wave.

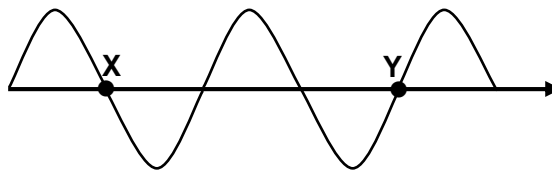


The symbols **A**, **B** and **C** respectively indicate the:

- A Amplitude; trough; wavelength
- B Crest; trough; wavelength
- C Amplitude; wavelength; pulse length
- D Crest; wavelength; trough

(2)

1.9 The diagram below shows two points, **X** and **Y**, on a transverse wave.



How many wavelengths separate points **X** and **Y**?

- A $\frac{3}{4}$
- B 1
- C $1\frac{1}{2}$
- D 3

(2)

1.10 Two waves, **A** and **B**, are produced by vibrating sources with the same frequency. **A** and **B** have wavelengths of 1 m and 3 m respectively. If the speed of wave **B** is v , the speed of wave **A** will be:

- A $\frac{1}{9}v$
- B $\frac{1}{3}v$
- C v
- D $3v$

(2)
[20]

QUESTION 2

- 2.1 Carbon dioxide and oxygen are some of the gases in the air around us.
- 2.1.1 Is air a HETEROGENEOUS or HOMOGENEOUS mixture? Give a reason for the answer. (2)
- 2.1.2 Define the term *pure substance*. (2)
- 2.1.3 Is carbon dioxide a PURE SUBSTANCE or a MIXTURE? (1)
- 2.1.4 Is oxygen gas an ELEMENT or a COMPOUND? Give a reason for the answer. (2)
- 2.2 You are supplied with a mixture of iron filings, marbles, sand and sugar.
- 2.2.1 Describe how you will separate these four substances. (4)
- 2.2.2 Which property of each of the following substances makes it possible to separate them from the above mixture?
- (a) Iron filings (1)
- (b) Sugar (1)
- [13]**

QUESTION 3

- 3.1 An element has the following electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^3$
- For this element, write down the:
- 3.1.1 Group number in the periodic table
Give a reason for the answer by referring to the above electron configuration. (2)
- 3.1.2 Period number in the periodic table
Give a reason for the answer by referring to the above electron configuration. (2)
- 3.2 Use Lewis structures to show the bond formation between aluminium (Al) and oxygen (O). Show all the steps involved. (3)
- 3.3 A certain element, **Q**, is in group II of the periodic table.
- For this element, write the:
- 3.3.1 Normal valency (1)
- 3.3.2 Number of valence electrons (1)
- 3.3.3 Chemical equation that shows the formation of the ion (2)
- 3.4 The symbol notation for a certain element is $^{27}_{13}\text{X}$.
- 3.4.1 Draw the energy level (Aufbau) diagram. (4)
- 3.4.2 Write down the NAME of the element. (1)
- [16]**

QUESTION 4

4.1 The letters **X**, **Z**, **Q** and **T** in the symbolic notations below represent four different elements.

$\begin{smallmatrix} 35 \\ 17 \end{smallmatrix} \text{X}^-$	$\begin{smallmatrix} 40 \\ 18 \end{smallmatrix} \text{Z}$	$\begin{smallmatrix} 39 \\ 19 \end{smallmatrix} \text{Q}^+$	$\begin{smallmatrix} 40 \\ 20 \end{smallmatrix} \text{T}^{2+}$
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Write down:

- 4.1.1 TWO differences in atomic structure between elements **X** and **Z** (2)
- 4.1.2 ONE similarity in atomic structure between elements **Q** and **T** (1)
- 4.1.3 The name of the element represented as an anion (1)
- 4.1.4 The number of neutrons in **X**⁻ (1)
- 4.1.5 ONE similarity in atomic structure between **X**⁻, **Z** and **T**²⁺ (1)
- 4.1.6 The element (**X**, **Z**, **Q** or **T**) with a noble gas structure (1)
- 4.1.7 The chemical symbol of element **T** (1)
- 4.2 Identify the type of bonding between particles in each of the following:
- 4.2.1 MgCl_2 crystal (1)
- 4.2.2 Cu (1)
- 4.2.3 H_2O molecule (1)
- 4.3 Write down the chemical formula of:
- 4.3.1 Bromine gas (1)
- 4.3.2 Ammonium phosphate (2)
- 4.3.3 Magnesium nitrate (2)
- 4.4 Write down the chemical names of:
- 4.4.1 NaHSO_3 (1)
- 4.4.2 ZnS (1)
- 4.5 Calcium and chlorine react to form a compound. Write down the ratio of cations to anions in this compound. (1)

[19]

QUESTION 5

The control rods in nuclear reactors often contain boron. Natural boron occurs as the following two isotopes:

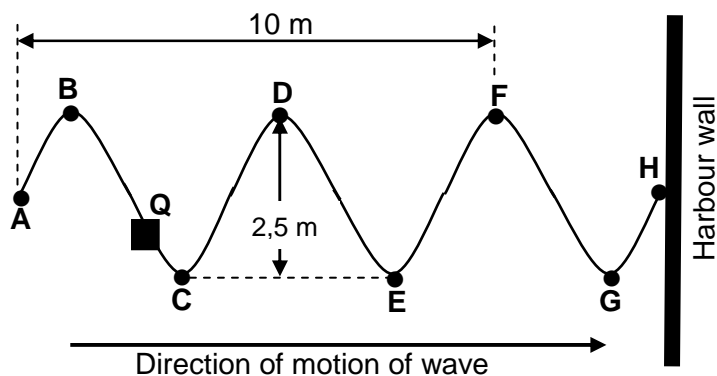
20% B-10 ($^{10}_5\text{B}$) and 80% B-11 ($^{11}_5\text{B}$)

- 5.1 Define the term *isotope*. (2)
- 5.2 Use the information given above to calculate the average atomic mass of boron. (3)
- 5.3 Name TWO subatomic particles which occur in equal numbers in the two isotopes. (2)
- 5.4 Name ONE subatomic particle of which the numbers differ in the two isotopes. (1)

[8]

QUESTION 6

Water waves crash against the wall around a harbour. Six waves hit the wall in 4 seconds. The height of a wave was found to be 2,5 m as shown in the diagram below. **Q** represents an object on the surface of the water.

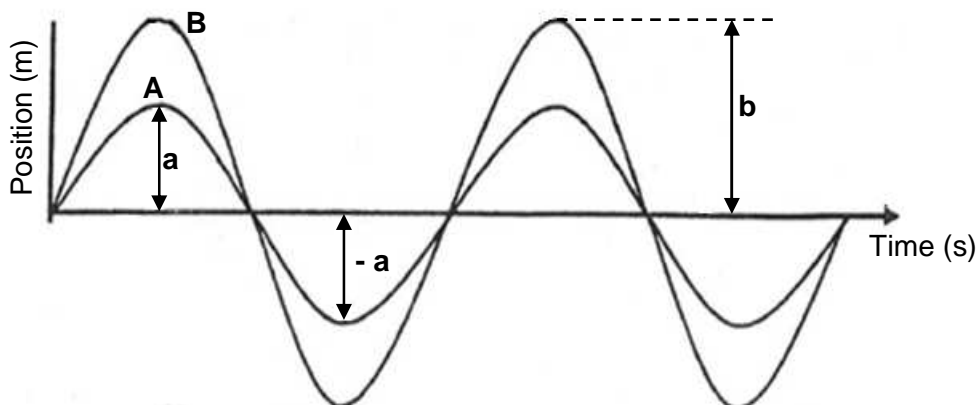


- 6.1 Define the term *transverse wave*. (2)
- 6.2 Write down ANY TWO letters (from **A** to **H**) which represent two points on the above wave that are:
 - 6.2.1 In phase (1)
 - 6.2.2 Out of phase (1)
- 6.3 In which direction is object **Q** about to move? (1)
- 6.4 Define the term *wavelength*. (2)
- 6.5 For the above wave, calculate the:
 - 6.5.1 Wavelength (1)
 - 6.5.2 Amplitude (1)
 - 6.5.3 Period (2)
 - 6.5.4 Frequency (2)
 - 6.5.5 Speed (3)

[16]

QUESTION 7

The diagram below shows two waves, **A** and **B**, which meet each other.



- 7.1 Write down the *principle of superposition*. (2)
- 7.2 How does each of the following properties of wave **A** compare to that of wave **B**? Choose from GREATER THAN, SMALLER THAN or EQUAL TO.
- 7.2.1 Wavelength (1)
- 7.2.2 Amplitude (1)
- 7.3 Draw the shape of the resulting wave as the two waves, **A** and **B**, meet at the time illustrated in the above diagram. On your sketch, show the resulting amplitude. (3)
- 7.4 Which wave property is illustrated in QUESTION 7.3? (1)
- [8]**

GRAND TOTAL: 100

**DATA FOR PHYSICAL SCIENCES GRADE 10
CONTROL TEST - TERM 1**

**GEGEWENS VIR FISIIESE WETENSKAPPE GRAAD 10
KONTROLETOETS - KWARTAAL 1**

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIIESE KONSTANTES

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

TABLE 2: FORMULAE / TABEL 2: FORMULES

WAVES, SOUND AND LIGHT / GOLWE, KLANK EN LIG

$v = f \lambda$	$f = \frac{1}{T}$ or/of $T = \frac{1}{f}$
Speed = $\frac{\text{dis tan ce}}{\text{time}}$	$E = hf = \frac{hc}{\lambda}$

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)
KEY/SLEUTEL																	
Atomic number Atoomgetal																	
Electronegativity Elektronegatiwiteit																	
Symbol Simbool																	
Approximate relative atomic mass Benaderde relatiewe atoommassa																	
2,1 1 H 1	1,0 3 Li 7	1,5 4 Be 9										2,0 5 B 11	2,5 6 C 12	3,0 7 N 14	3,5 8 O 16	4,0 9 F 19	10 Ne 20
0,9 11 Na 23	1,2 12 Mg 24											1,5 13 Al 27	1,8 14 Si 28	2,1 15 P 31	2,5 16 S 32	3,0 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	1,8 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	57 La 139	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															
			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	