



# education

Department of  
Education  
FREE STATE PROVINCE

**CONTROL TEST**

**GRADE 10**

**PHYSICAL SCIENCES**

**MARCH 2019**

**MARKS: 100**

**TIME: 2 HOURS**

**This paper consists of 13 pages and TWO data 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 EIGHT 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.

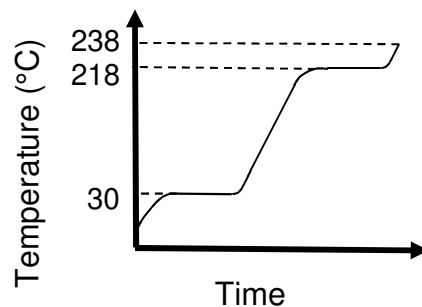
1.1 Which one of the following is NOT an element?

- A Water
- B Carbon
- C Oxygen
- D Hydrogen (2)

1.2 When dry ice (solid  $\text{CO}_2$ ) is heated, it goes directly from the solid phase to the gaseous phase. This is an example of ...

- A condensation.
- B evaporation.
- C sublimation.
- D melting. (2)

1.3 The heating curve of a certain substance is shown below.

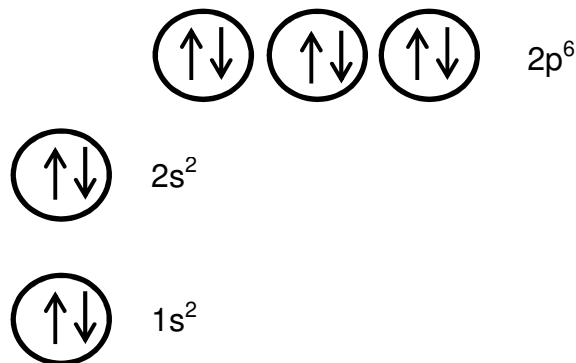


The melting point of this substance, in°C, is most probably ...

- A 30.
- B 80.
- C 218.
- D 238. (2)

- 1.4 The name for  $\text{CaF}_2$  is ...
- A potassium bifluoride.
  - B calcium difluoride.
  - C calcium difluorine.
  - D potassium fluorine. (2)
- 1.5 Which substances are made of particles according to the kinetic molecular theory?
- A All matter except solids
  - B Gases only
  - C Liquids only
  - D All matter (2)
- 1.6 What cause the high density of solids?
- A Particles of solids are heavier than those in liquids.
  - B The forces between the particles are weak.
  - C The particles are packed closely together.
  - D The energy of the particles is very high. (2)
- 1.7 Which scientist discovered the nucleus?
- A Niels Bohr
  - B J.J Thompson
  - C James Chadwick
  - D Ernest Rutherford (2)

- 1.8 Consider the following Aufbau diagram as well as one atom and three ions represented by (i), (ii), (iii) and (iv).

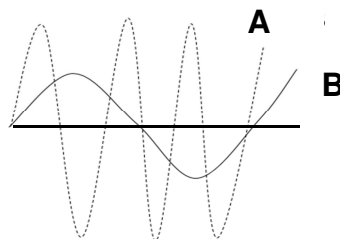


- (i) Ne  
(ii)  $\text{F}^-$   
(iii)  $\text{Na}^+$   
(iv)  $\text{O}^{2-}$

Which of (i), (ii), (iii) and/or (iv) is/are represented by the Aufbau diagram?

- A (i)  
B (ii) and (iii)  
C (i), (ii) and (iii)  
D (i), (ii), (iii) and (iv) (2)

- 1.9 The diagram below represents two sound waves, **A** and **B**, on an oscilloscope.



Which one of the following statements regarding **A** and **B** is correct?

- A Wave **A** represents a louder and higher sound than wave **B**.  
B Wave **A** represents a softer and higher sound than wave **B**.  
C Wave **A** represents a louder and lower sound than wave **B**.  
D Wave **A** represents a softer and lower sound than wave **B**. (2)

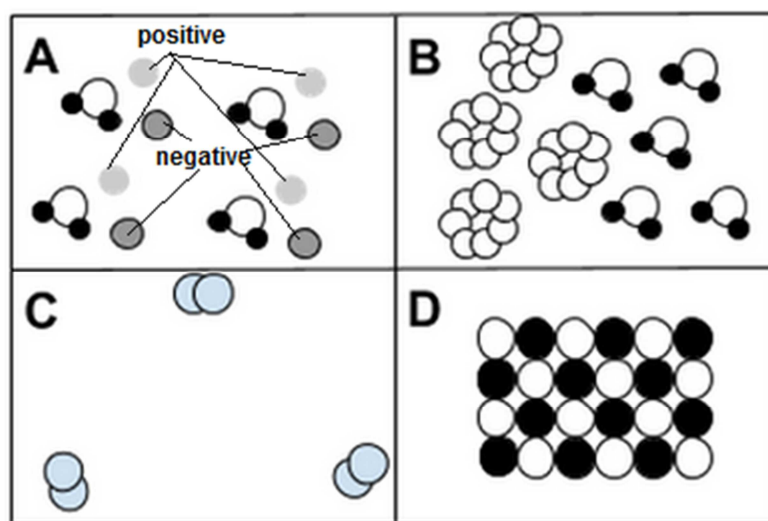
1.10 Which one of the following is a longitudinal wave?

- A Visible light
- B Sound wave
- C Mexican wave
- D A wave in the sea

(2)  
[20]

## QUESTION 2

2.1 The diagram below shows the particles in a variety of substances.



Refer to the diagram given above and indicate which substance(s) represent(s):

- 2.1.1 A solid (1)
- 2.1.2 A homogeneous mixture (1)
- 2.1.3 A heterogeneous mixture (1)
- 2.1.4 A pure substance (1)
- 2.1.5 An element (1)
- 2.1.6 Diatomic molecules (1)
- 2.1.7 A compound (1)
- 2.1.8 A gas (1)

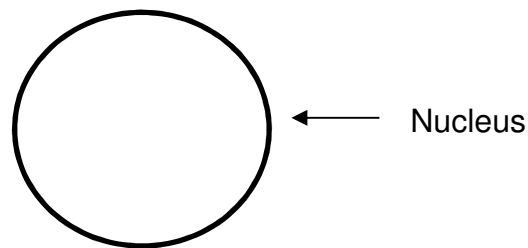
- 2.2 Oxygen is a highly reactive element and is a gas at room temperature. It forms a blue liquid at very low temperatures.

2.2.1 Write down the mass number for the element oxygen. (1)

2.2.2 Draw an Aufbau diagram for an oxygen atom. (4)

2.2.3 Use the sp-notation to write down the electron configuration of an oxygen atom. (2)

2.2.4 Redraw the following atomic structure in your answer book.



Complete this atomic structure for an oxygen ion ( $O^{2-}$ ).  
Clearly label the protons, neutrons and electrons. (4)

- 2.3 The isotopic composition of oxygen atoms in the earth's atmosphere is 99,759% of  $^{16}_8O$ , 0,037% of  $^{17}_8O$  and 0,204% of  $^{18}_8O$ .

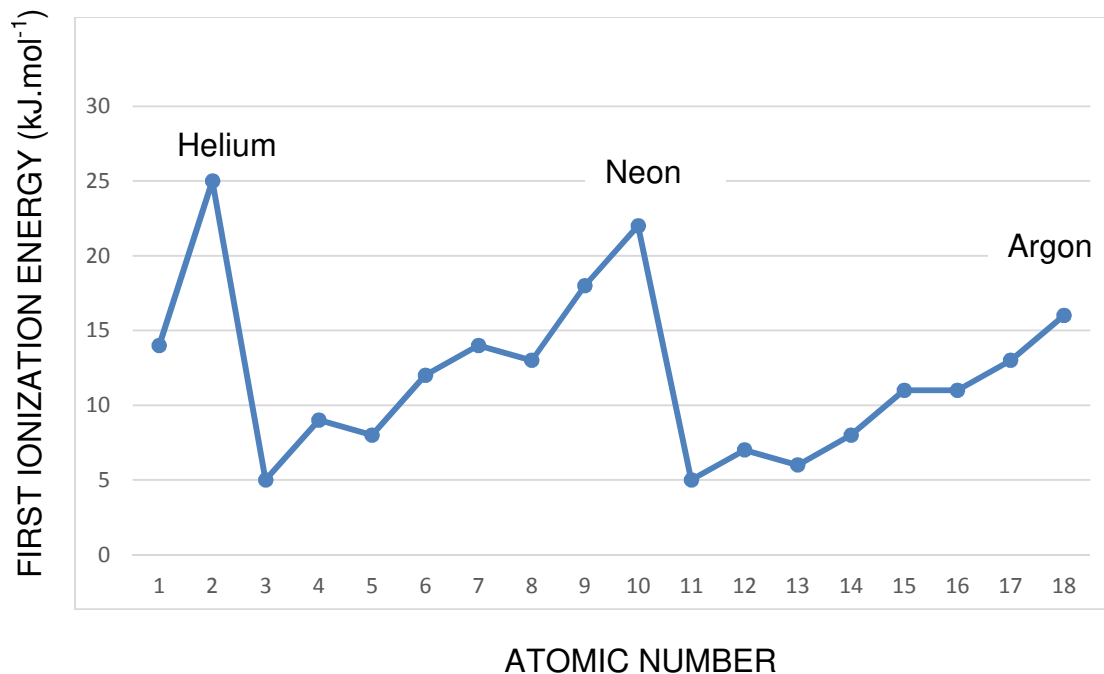
2.3.1 Define the term *isotope*. (2)

2.3.2 Calculate the relative atomic mass of oxygen. (5)

**[26]**

### QUESTION 3

- 3.1 The graph below indicates the first ionization energy for a number of elements. Study the graph and answer the questions that follow.



- 3.1.1 Write down the definition of the *first ionization energy*. (2)
- 3.1.2 What is the relationship between the ionization energies of the noble gases and their positions on the periodic table? (2)
- 3.1.3 Give reasons for the observation made in QUESTION 3.1.2. (3)
- 3.1.4 How much is the first ionization energy, in  $\text{kJ}\cdot\text{mol}^{-1}$ , of sodium? (1)
- 3.1.5 Except for similar ionization energies, state one property that the two elements with the LOWEST ionization energy have in common. (2)



3.2 Some properties of elements on the periodic table are given below.

Element	Melting point (°C)	Atomic radius (pm)	Ionisation energy	Electro-negativity
Li	180,54	128	52	1
Be	1 278	96	900	1,5
B	2 300	84	801	2
C	3 500	76	1 087	2,5
N	-209,9	71	1 402	3
O	-218,4	66	1 314	3,5
F	-219,62	57	1 681	4
Ne	-248,6	58	2 081	

3.2.1 Name one property that all elements in the table have in common. (1)

3.2.2 What is the relationship between the melting points and atomic numbers of the NON-METALS listed in the table? (1)

3.2.3 What is the relationship between the size of an atom and the atomic number for all the elements listed in the table? (1)

3.2.4 Define the term *electronegativity*. (2)

3.2.5 Explain why there is no value for electronegativity for neon. (2)  
**[17]**

#### QUESTION 4

The following questions are based on two compounds, HCl and NaCl, and the element Na.

4.1 Which one of these compounds is an IONIC compound? (1)

4.2 Give a reason for your answer to question 4.1. (2)

4.3 Which one of these compounds consists of MOLECULES? (1)

4.4 Draw the Lewis diagram of HCl. (2)

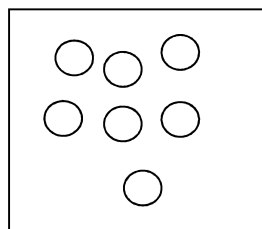
4.5 Explain, by using the different types of bonding, why:

4.5.1 NaCl crystals do not conduct electricity. (2)

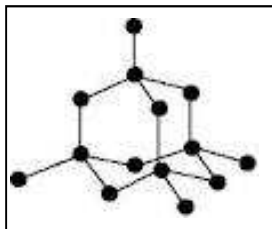
4.5.2 The metal Na conducts electricity. (2)  
**[10]**

### QUESTION 5

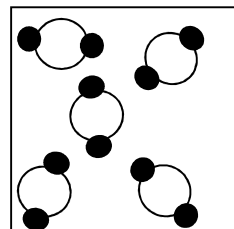
Consider the following diagrams and answer the questions below.



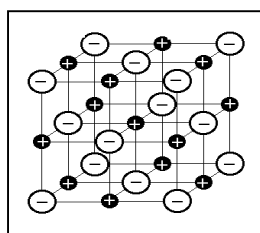
**A**



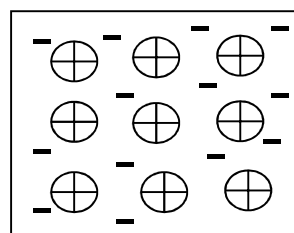
**B**



**C**



**D**



**E**

Choose from the different diagrams the one that best describes each of the following substances. Write down the letter (A – E) only.

- |     |                 |     |
|-----|-----------------|-----|
| 5.1 | Diamond         | (1) |
| 5.2 | Carbon dioxide  | (1) |
| 5.3 | Helium          | (1) |
| 5.4 | Magnesium       | (1) |
| 5.5 | Sodium Chloride | (1) |

**[5]**

## QUESTION 6

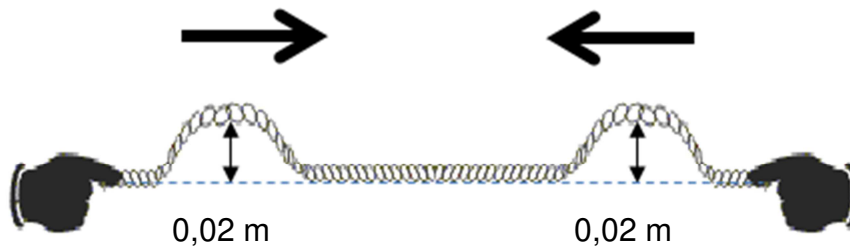
A pulse is generated in a string as shown in the picture below.



6.1 Write down the definition of a *pulse*. (2)

6.2 What type of pulse is generated in the string? Give a reason for your answer. (2)

6.3 Two pulses are generated in the same string, but from opposite directions as shown below.

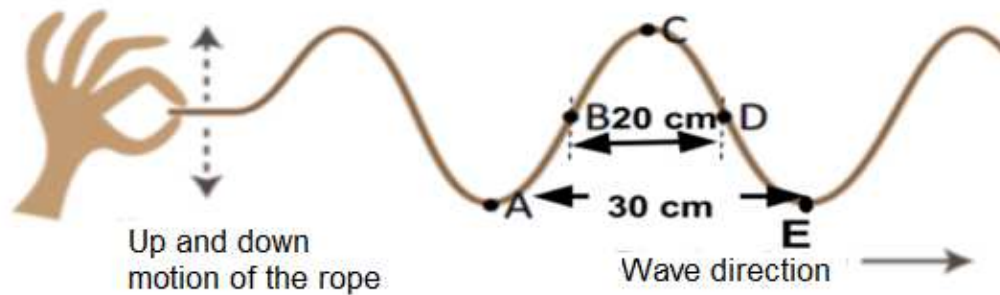


6.3.1 Explain what you will observe when these two pulses meet each other. Include a number that will help you to explain your observation. (3)

6.3.2 What type of wave is formed if the one hand moves to and fro in the direction PARALLEL to the string while the other hand remains stationary? (1)  
[8]

### QUESTION 7

A learner generates a wave by moving the end of a rope up and down as shown in the diagram below. The other end of the rope is fixed to a wall. The distance between **A** and **E** is 30 cm while the distance between **B** and **D** is 20 cm.



7.1 Use the letters **A**, **B**, **C**, **D** and/or **E** and indicate two points that are IN PHASE. (2)

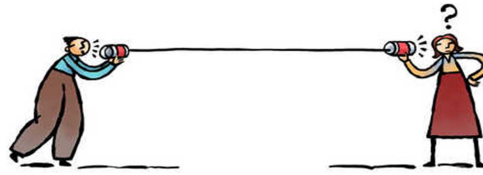
7.2 Calculate the frequency of the wave if it takes the learner 2 s to go up from the position of rest, then down and then up again to its original position. (3)

7.3 Calculate the speed of the wave in  $\text{m}\cdot\text{s}^{-1}$ . (3)

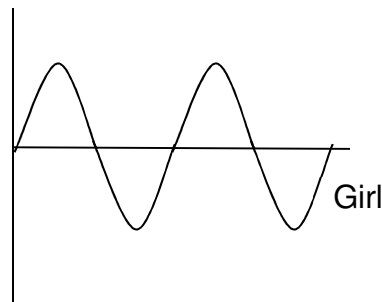
7.4 In which direction will point **B** move FIRST when the wave continues to propagate through the rope? (1)  
[9]

## QUESTION 8

A boy and a girl communicate on a string telephone as shown below.



- 8.1 Explain, by referring to the movement of the particles in the string, how sound waves are propagated through the string. (2)
- 8.2 Explain why you are able to hear a person clearly over a distance on a string telephone compared to air even if he does not speak very loud. (1)
- 8.3 The BOY in the diagram has a LOWER and LOUDER voice than the girl. The diagram below illustrates the SOUND that the GIRL is making. Redraw the diagram in your answer book. Use a DOTTED line to draw the SOUND GRAPH of the BOY so that the differences between the two sound waves clearly show.



(2)  
[5]

**GRAND TOTAL: 100**

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

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

**TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIESE KONSTANTES**

NAME / NAAM	SYMBOL / SIMBOOL	VALUE / WAARDE
Speed of light in a vacuum <i>Spoeed 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**

$v = \lambda f$	$f = \frac{1}{T}$ or/of $T = \frac{1}{f}$
$speed = \frac{distance}{time}$ $spoed = \frac{afstand}{tyd}$	$E = hf = \frac{hc}{\lambda}$

## TABLE 2: THE PERIODIC TABLE OF ELEMENTS

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)
1 H 1																	2 He 4
3 Li 7	4 Be 9																10 Ne 20
11 Na 23	12 Mg 24																18 Ar 40
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 63,5	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 86	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 98	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 147	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	
87 Fr 226	88 Ra 226	89 Ac 227	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 288	102 No 289	103 Lr 260	

KEY/SLEUTEL

Atomic number  
Atoomgetal

Electronegativity  
Elektronegatiwiteit

Symbol  
Simbool

Approximate relative atomic mass  
Benaderde relatiewe atoommassa

29

1,9

Cu

63,5