Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2020

TECHNICAL SCIENCES P2 (EXEMPLAR)

MARKS: **150**

TIME: **3 hours**

This question paper consists of pages 17, including 2 data sheets.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. You may use a non-programmable calculator.
5. Leave ONE line open between subquestions, i.e. 2,1 and 2 .2.
6. Show ALL formulae and substitutions in ALL calculations.
7. Round off your FINAL numerical answers to a minimum of TWO decimal places.
8. Give brief motivations, discussions, et cetera where required.
9. A data sheet and a periodic table are attached for your use.
10. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1-1.10) in the ANSWER BOOK, for example 1.11 D.

1.1 The distance between any two successive points which are in the same phase, is the …

A period.

B wavelength

C oscillation.

D transverse wave. (2)

1.2 Which ONE of the following statements concerning waves is false?

A All waves transfer energy.

B All waves can be reflected.

C All waves require a medium to be propagated.

D All waves can experience a change in direction if they enter a new medium. (2)

1.3 The frequency of 1 Hertz is equivalent to …

A 1 $m \bullet s^{-1.}$

B 1 s.

C 1 $m \bullet s^{-2.}$

D 1 $s^{-1.}$ (2)

1.4 The speed of a wave is 4 $m \bullet s^{-1}$. If the frequency of the wave is 8 Hz, calculate the period of the wave.

A 2 s

B 0,5 s

C 32 s

D 0,125 s (2)

1.5 The wavelength of a sound wave is …

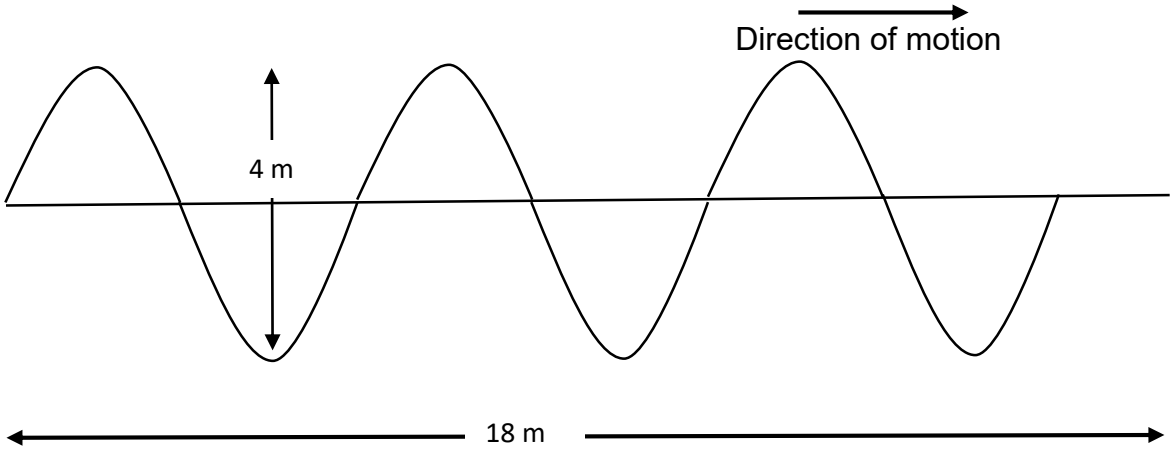
A the same in all kinds of media.

B the longest in gases.

C the shortest in liquids.

D the longest in a solid. (2)

1.6 The following diagram represents a wave with a frequency of 20 Hz.



The wavelength of this wave is …

A 9 m.

B 18 m.

C 6 m.

D 4 m. (2)

1.7 The SI unit for specific heat capacity is the:

A Kelvin

B Joules per Kilogram Kelvin

C Joules

D Joules per Kilogram (2)

1.8 The formula that gives the relationship between heat capacity and specific heat capacity correctly, is …

A Q = $mc\Delta t$.

B C = $\frac{m}{c}$.

C C = $\frac{Q}{\Delta t}$.

D C = mc. (2)

1.9 A learner left a solution of copper sulphate in a zinc container overnight. The next morning a brown insoluble substance coated the sides and bottom of the zinc container. The container was corroded and some of the solution had leaked to the floor.

Which ONE of the following reactions took place inside the zinc container?

A $Cu(s) + ZnSO_4(aq) \rightarrow CuSO_4(aq) + Zn(s)$

B $Cu^{2+}(aq) + ZnSO_4(aq) \rightarrow CuSO_4(aq) + Zn(s)$

C $Zn^{2+}(aq) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu^{2+}(aq)$

D $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$ (2)

1.10 In the reaction …

$$Zn + Pb^{2+} \rightarrow Zn^{2+} + Pb$$

is the …

A zinc ion is the reducing agent.

B lead ion is the reducing agent.

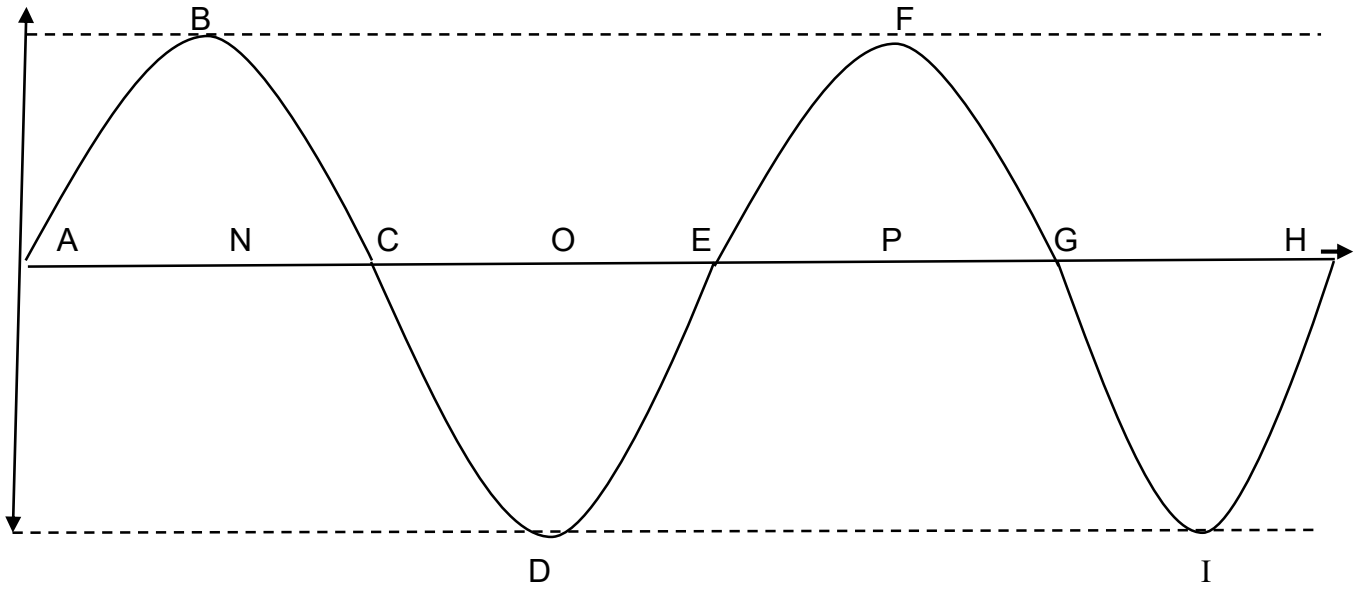
C lead ion is the oxidising agent.

D zinc ion is the oxidising agent. (2)

[20]

QUESTION 2 (Start on a new page.)

Consider the diagram below. It shows different points generated in a transverse wave pattern.



2.1 Distinguish between a *pulse* and a *wave*. (4)

2.2 Give TWO points that are in phase in the diagram above. (2)

2.3 Which line in the diagram represents equilibrium position? (2)

2.4 Give TWO points between which the perpendicular distance represents the amplitude of the wave. (2)

2.5 How can the frequency of the wave be calculated if the period of the wave is known? (2)

2.6 Define the following terms associated with waves:

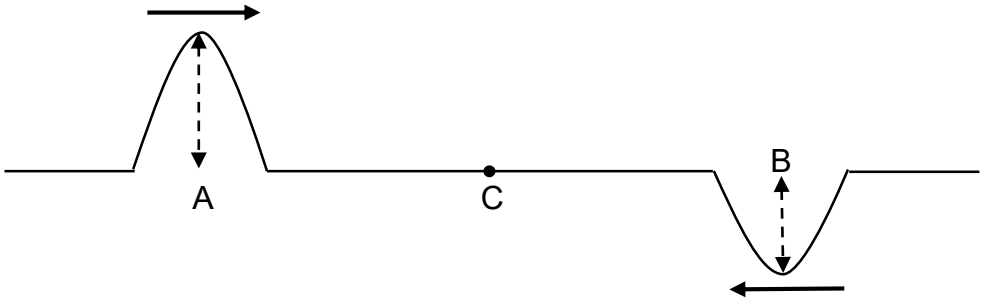
2.6.1 *Period* of the wave (2)

2.6.2 *Frequency* (2)

2.6.3 *Transverse wave* (2)

2.7 Calculate the speed of a wave with a wavelength of 10 m that is produced by a vibrating source with a frequency of 0,25 Hz. (3)

2.8 Two pulses, **A** and **B**, are generated (made) by students as they move their wands, using the magic charm, 'Mobiliarbus'. These pulses move at the same speed along a light string.
Pulse **A** is moving to the right with an amplitude of +7 cm, while pulse B is moving to the left with an amplitude of +3 cm. Pulses **A** and **B** meet at position **C**. Assume that all energy is conserved.



2.8.1 What type of interference will take place when these two pulses meet? (1)

2.8.2 What is the magnitude of the amplitude of the pulses as they meet at point **C**? (2)

2.8.3 Describe this type of interference in QUESTION 2.8.1, in words. (2)
[26]

QUESTION 3 (Start on a new page.)

A boy observes the waves entering a harbour. He notices that 31 peaks pass a pole protruding (coming out) from the water every minute. He also observes that a peak takes 2 s to cover a distance of 20 m.

Calculate:

3.1 The period of the waves (4)

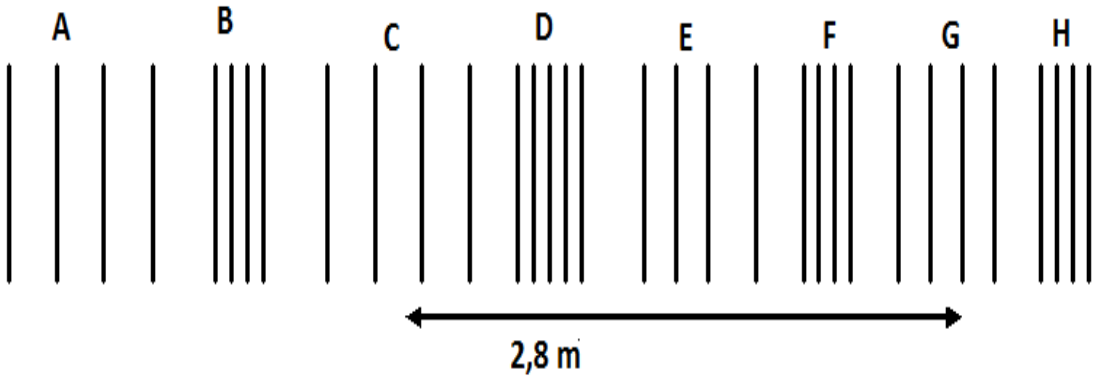
3.2 The speed of the waves (3)

3.3 The wavelength of the waves (4)

[11]

QUESTION 4 (Start on a new page.)

The diagram below shows the pattern obtained for a sound wave. A string vibrates with a period of 0,002 s.



4.1 Define a *longitudinal wave.* (2)

4.2 Calculate the wavelength of the sound it produces if sound travels at 340 $m \cdot s^{-1}$ through air. (4)

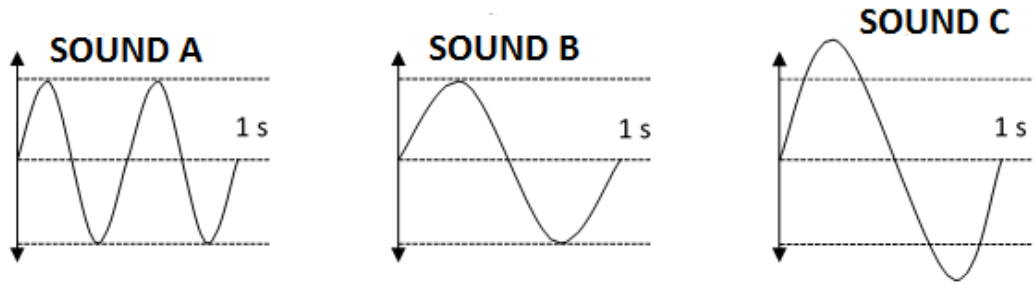
4.3 What will happen to the following when sound waves enter a steel object?

4.3.1 Frequency (1)

4.3.2 Speed (1)

4.3.3 Wavelength (1)

4.4 Anything that generates a disturbance in the air creates a pulse that travels away from the place where it is created. If this pulse enters your ear, it may cause your eardrum to vibrate, which is how one hears. Consider the three diagrams below that illustrate different sound waves on an oscilloscope.



4.4.1 Define the term *pitch* in words. (2)

4.4.2 Which ONE (**A, B** or **C**) is the loudest sound? Explain your answer. (3)

4.4.3 Which ONE (**A, B** or **C**) has the highest pitch? Explain your answer. (3)

4.5 Give TWO uses of ultrasound. (2)

4.6 Write down TWO uses of infrasound. (2)

[21]

QUESTION 5 (Start on a new page.)

A ship is 850 m from a vertical cliff. The ship's siren is sounded and an echo is heard after 5 s.

5.1 Define the term *echo.* (2)

5.2 Calculate the speed of sound from this information. (4)

5.3 Calculate the wavelength of the sound produced by the siren if the frequency is 200 Hz. (3)

5.4 In what frequency range must a sound be in order to be audible to the human ear? (2)

5.5 What value must the wavelength of a note have to be audible in air? (2)

[13]

QUESTION 6 (Start on a new page.)

Thermodynamics is the branch of Technical Sciences that is built upon the fundamental laws which Heat and Work obey. In our study we saw that these laws place additional restrictions on the use of energy in the form of heat and work, restrictions that the law of conservation of energy do not imply.

6.1 State the Law of conservation of heat. (2)

6.2 520 kJ of heat energy is supplied to a certain machine. 310 kJ of this energy is converted mechanical work.

Calculate the change in internal energy of this machine. (3)

6.3 Define a *working substance* in technology. (2)

6.4 Give TWO examples of working substance. (2)
[9]

QUESTION 7 (Start on a new page.)

7.1 Define *specific heat capacity*. (2)

7.2 Distinguish between a *Surrounding* and *Thermodynamic system*. (4)

7.3 Suppose you are given 1 ℓ of water in a container and in another container 1 ℓ ethyl of alcohol.

7.3.1 Which ONE of the 1 ℓ liquids can be used as an excellent coolant? (1)

7.3.2 Explain your answer in QUESTION 7.3.1 using the specific heat capacities of the two liquids. (2)

7.4 220 g of water at 90 °C is added to a certain unknown mass of water at 10 °C. The final temperature of the mixture is 33 °C.

Calculate the unknown mass of the water. (4)

7.5 Pieces of warm copper, mass 100 g at a temperature of 81 °C, is added to 200 g of water at a temperature of 15 °C. The highest final temperature is 18 °C.

Calculate the specific heat capacity of copper. (7)
[20]

QUESTION 8 (Start on a new page.)

Chemical changes deal with a variety of chemical reactions including Electrochemistry, which is the branch that deals with energy conversions due to chemical reactions.

8.1 Differentiate between *oxidation* and *reduction* reactions. (4)

8.2 Determine the oxidation numbers of each of the underlined elements. Write down every step which will show how you arrived at your answer.

8.2.1 $\underline{\mathbf{Mn}}O_2$ (2)

8.2.2 $K_2\underline{\mathbf{Cr}}_2O_7$ (2)

8.2.3 $\underline{\mathbf{N}}H_4^+$ (2)

8.3 Consider the following balanced chemical reaction:

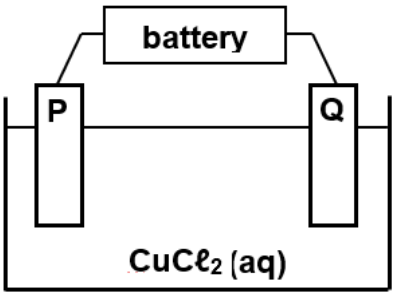
$2K_2O \rightarrow 4K + O_2$

Identify the substance which is:

8.3.1 Oxidised (2)

8.3.2 Reduced (2)

8.4 The experimental set-up below was used by learners of Technical Sciences to investigate the electrolysis of a copper chloride solution ($CuCl_2(aq)$).



8.4.1 Define the term *electrolyte*. (2)

8.4.2 Why is carbon preferred as an electrode? (2)

8.4.3 What observation will be made at electrodes **P** and **Q**? (4)

8.4.4 Which ONE, electrode **P** or **Q**, is the anode and which ONE, electrode **P** or **Q**, is the cathode? (2)

8.4.5 Write down the half reaction that will take place at the cathode. (2)

8.4.6 Write down the half-reaction taking place at the anode. (2)

8.4.7 State TWO uses of electrolysis in Technology. (2)

[30]

TOTAL: 150

INFORMATION FOR TECHNICAL SCIENCES GRADE 11
PAPER 2

GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 11
VRAESTEL 2

TABLE 1: SPECIFIC HEAT CAPACITIES/*TABEL 1: SPESIFIEKE HITTEKAPASITEITE*

Name/*Naam*	Values/*Waardes* ($J.kg^{-1}.K^{-1}$)
Water	4 200
Copper / *Koper*	400
Aluminium	900
Glass / *Glas*	700
Ethyl alcohol / *Etielalkohol*	2 460
Iron / *Yster*	460
Zinc / *Sink*	380
Lead / *Lood*	130
Ice / *Ys*	2 100
Brass	380
Mercury / *Kwik*	140
Methylated spirits / *Brandspiritus*	2 400

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

HEAT AND THERMODYNAMICS/HITTE EN TERMODINAMIKA

$C = c\ m$	$Q = c\ m\ \Delta T$	$\Delta Q = \Delta U + \Delta W$

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$f = \frac{1}{T}$	$\Delta v = \frac{\Delta x}{\Delta t}$
$T = \frac{1}{f}$	$v = f\lambda$

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