Kzn education

Department:
Education
KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: PHYSICS (P1)
NOVEMBER 2022

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MARKS: 125

TIME: 2½ hours

This question paper consists of 8 pages and 1 data sheet.

INSTRUCTIONS AND INFORMATION

1. Write your name and class (e.g. 10A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 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 question paper.
5. Leave ONE line between subquestions, e.g. 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, etc. where required.
12. 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 to 1.7) in the ANSWER BOOK, e.g. 1.11 E. Each question has only ONE correct answer.

1.1 Which ONE of the following combinations includes TWO scalar quantities and ONE vector quantity?

A Displacement, acceleration, speed
B Speed, velocity, distance
C Force, mass, acceleration
D Displacement, acceleration, velocity (2)

1.2 The frequency of a wave is defined as….

A number of complete waves per second
B number of points in phase in a wavelength
C time taken for one complete wave
D lowest point on a wave (2)

1.3 The maximum work done per unit charge by a battery is the …

A emf.
B current
C resistance
D terminal potential difference (2)

1.4 An object of mass *m* is dropped from a balcony and strikes the ground with kinetic energy *E*.
A second object of mass 2*m* is dropped FROM THE SAME HEIGHT. It's kinetic energy in terms of E is ….

A ¼*E*
B *E*
C *2E*
D ½*E* (2)

1.5 Which of the following elements have the same number of valence electrons?

A Li, Na and K
B Ca, Mg and S
C As , P and Cl
D Si, Na and Mg (2)

1.6 during the formation of a covalent bond electrons are …

A transferred from a metal to a non-metal.
B transferred from a non-metal to a metal.
C shared between two metals.
D shared between a metal and a non-metal. (2)

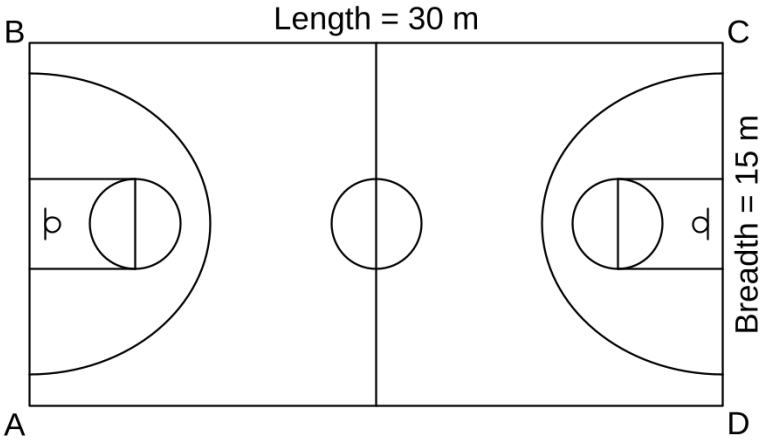
1.7 Which of the following is the correct name for the ion $H_2PO_4^-$.

A Dihydrogen Phosphide
B Hydrogen Phosphate
C Dihydrogen Phosphate
D Phosphide (2)

[14]

QUESTION 2 (Start on a new page)

During a practice session, a basketball player runs around the basketball court starting from point A. He runs to point B, C, D and then returns to point A.



2.1 Define displacement (2)

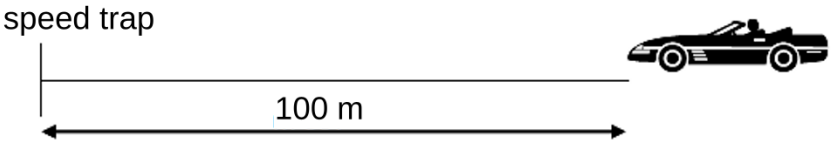
2.2 Draw a vector diagram showing the movement of the basketball player for one (1) lap around the court. (Ensure diagram is fully labelled).
Use scale 1cm: 5m (3)

2.3 It takes the basketball player 19 seconds to complete one (1) lap around the court. Calculate his average velocity. (3)

[8]

QUESTION 3 (Start on a new page)

A car is driven at 20 $m.s^{-1}$ when the driver sees a traffic officer at a speed trap 100 m away. He realises he is travelling too fast and applies the brakes of the car. His reaction time is 1 s. The speed limit on this road is 16,66 $m.s^{-1}$.



3.1 Define acceleration. (2)

3.2 Calculate how far the car moves from the time the driver first notices the speed trap until he applies his brakes. (3)

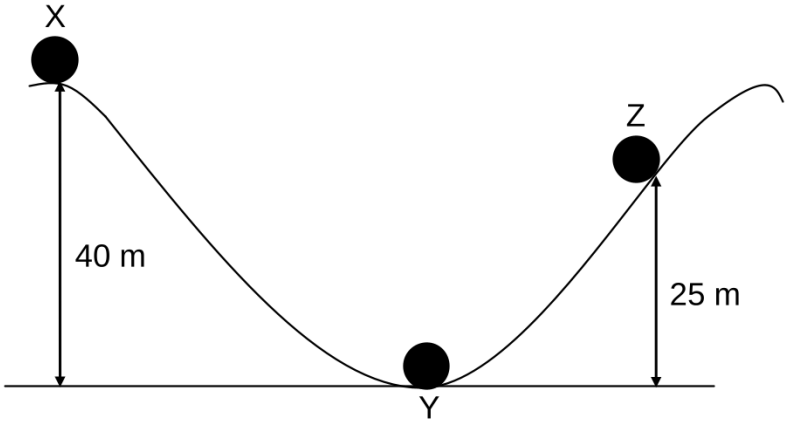
3.3 Calculate how long it takes him to reach the speed trap from the time he applied his brakes if his speed is 16 $m.s^{-1}$ when he reaches the speed trap. (5)

3.4 Draw a sketch graph of velocity versus time for the motion from the time he first notices the speed trap until he reaches the speed trap.
Include all relevant time and speed values. (5)

[15]

QUESTION 4 (Start on a new page)

A steel ball of mass 200kg starts from rest at X, a height of 40m above the lowest point Y on a frictionless track. The steel ball then rolls down the track to point Y.
(Ignore any air resistance)



4.1 State the principle of conservation of mechanical energy in words. (2)

4.2 Use the principle of conservation of mechanical energy to:

4.2.1 Calculate the gravitational potential energy at X. (3)

4.2.2 State the kinetic energy at point Y. (1)

4.3 Calculate the velocity of the rollercoaster at Z. (4)

[10]

QUESTION 5 (Start on a new page)

Two insulated X and Y graphite-coated polystyrene spheres are kept stationary on an insulated surface a small distance apart. The charges on the spheres are – 5 nC and + 2 nC; respectively. When the spheres are released they move towards each other.



5.1 State the Law of Conservation of Charge. (2)

The two spheres are released and are free to move.

5.2 Give a reason why the spheres move towards each other when they are released. (1)

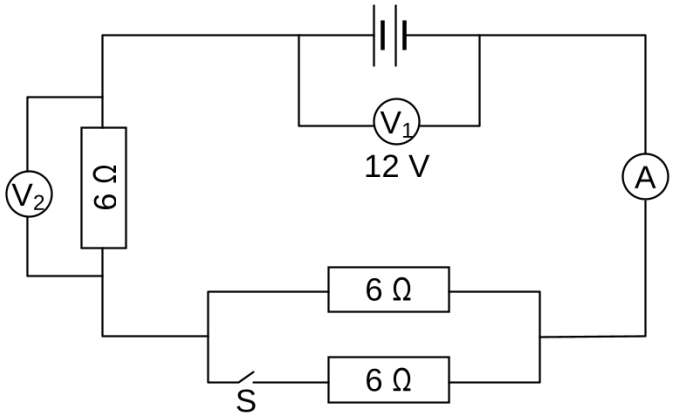
5.3 Calculate the new charge on each sphere after they are allowed to touch. (3)

5.4 Were electrons transferred FROM X to Y or FROM Y to X?
Give a reason for your answer (2)

[8]

QUESTION 6 (Start on a new page)

Study the circuit diagram below. The three resistors are identical and each has a resistance of 6 Ω. Voltmeter $\mathbf{V_1}$ has a reading of 12 V.



Switch S is initially open.

6.1 Calculate the reading on the ammeter (4)

6.2 Calculate the reading on voltmeter V_2 (3)

Switch S is now closed.

6.3 Calculate the resistance of the two resistors in parallel (3)

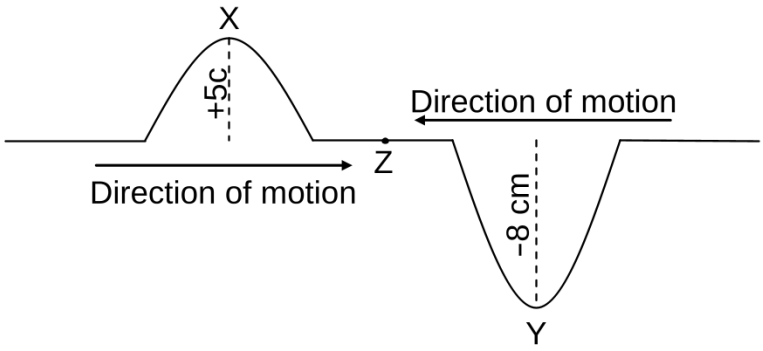
6.4 How did the reading on the ammeter change when the switch was closed?
Write down INCREASE, DECREASE or REMAINS THE SAME. (1)

[11]

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QUESTION 7 (Start on a new page)

7.1 Two transverse pulses, **X** and **Y**, are moving at the same time at the same speed along a light string. Pulse **X** is moving to the right with an amplitude of **+5 cm**, while pulse **Y** is moving to the left with an amplitude of −8 **cm**. Pulses **X** and **Y** meet at position **Z**. Assume that all energy is conserved.



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

7.1.2 Make a labelled sketch to represent these two pulses when they meet at point Z. Show the amplitude on your sketch. (2)

7.1.3 How will the amplitude of pulse X change after the interference with pulse Y at point Z?
Write only INCREASE, DECREASE or STAY THE SAME. (1)

7.2 A wave travels at a speed of the 0,5 $m \cdot s^{-1}$. The distance between 9 consecutive wave crests of a transverse wave is 16 cm.

7.2.1 Give the definition of *transverse wave*. (2)

7.2.2 Determine the wavelength of the wave in meters. (1)

7.2.3 Calculate the frequency of the wave. (4)

7.3 An X-ray photon incident on a body has a wavelength of 2,1 x 10^{-9} m.
Calculate how much energy the photon imparts to the body. (4)

[15]

QUESTION 8 (Start on a new page)

8.1 Carbon dioxide, Nitrogen and oxygen are some of the gases that exist in the air around us.
Is air a heterogeneous or homogenous mixture?
Give a reason for your answer. (2)

The table below shows some chemical substances.

A	B	C	D
O^{2-}	I	Si	Li

8.2 Write down the LETTER ONLY that represents a metalloid. (1)

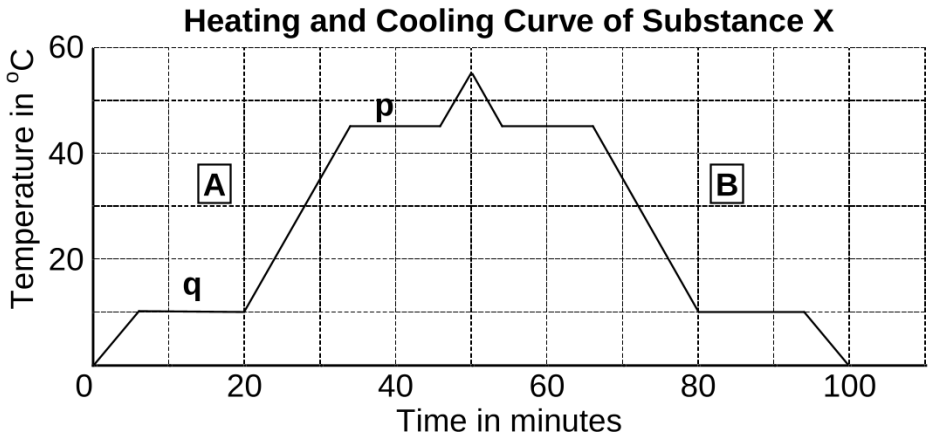
8.3 Write down the formula of the chemical substance formed when E and C combine. (1)

[4]

QUESTION 9 (Start on a new page)

The heating and cooling curve of substance X is drawn below.





9.1 Define the term boiling point. (2)

9.2 At which temperatures does substance X freeze? (1)

9.3 Write down the change in temperature for stage **p**.
Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)

9.4 Using the kinetic molecular theory, explain the answer to QUESTION 9.1.3 above. (3)

9.5 State the phase change that takes place during stage q. (1)

[8]

QUESTION 10 (Start on a new page)

10.1 Magnesium has three isotopes that exist in nature in varying abundance.
Mg-23 (% abundance 42%), Mg-24 (% abundance 10%) and
Mg-25 (% abundance x%)

10.1.1 Define the term isotopes. (1)

10.1.2 Calculate the percentage abundance of Mg-25. (1)

10.1.3 Calculate the relative atomic mass of magnesium. (3)

10.1.4 Draw the Aufbau diagram for ion of magnesium. (2)

10.2 The sp notation of element X is given below:

$$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$$

Write the following for element X.

10.2.1 The period where this element will be found. (1)

10.2.2 The symbol (1)

Magnesium bonds with element X to form a compound

10.2.3 What type of bond will form between magnesium and element X. (1)

10.2.4 Draw the Lewis diagram to show the formation of the bond (Show all steps) (3)

[13]

QUESTION 11 (Start on a new page)

11.1 The percentage composition of the platinum-based anti-cancer drug cisplatin is summarised in the table below:

Elements	Pt	Cl	N	H
Mass %	65 %	?	9,33 %	2 %

11.1.1 Define the term empirical formula. (2)

11.1.2 Use the above information to determine the empirical formula of cisplatin. Show **ALL** calculations. (4)

11.2 A learner has a 250 cm^3 volumetric flask in which to prepare a standard solution of potassium permanganate, $KMnO_4$.

11.2.1 Calculate the percentage mass of oxygen in potassium permanganate. (2)

11.2.2 What mass of $KMnO_4$ is needed to make a solution with a concentration of 0,45 $mol.dm^{-3}$? (4)

11.3 A solution that contains 12,0 g of NaI reacts completely with a solution that contains 13,2 g of $Pb(NO_3)_2$, producing PbI_2 and $NaNO_3$. This reaction is represented by the balanced chemical equation below:



$$Pb(NO_3)_2\ (aq) + 2\ NaI\ (aq) \rightarrow PbI_2 + 2\ NaNO_3$$

11.3.1 Calculate the mass of PbI_2 produced. (4)

11.3.2 Calculate the number of molecules in PbI_2. (3)

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TOTAL: 125

DATA FOR PHYSICAL SCIENCES – GRADE 10 PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Speed of light in a vacuum	c	$3,0 \times 10^{8}$ m·s^{-1}
Charge on electron	e	$-1,6 \times 10^{-19}$ C
Electron mass	m_e	$9,11 \times 10^{-31}$ kg
Planck's Constant	h	$6,63 \times 10^{-34}$ J.s

TABLE 2: FORMULAE

Motion	Energy	Waves, Sound and Light
$v_f = v_i + a\Delta t$	$U = mgh \;/\; E_p = mgh$	$c = f\lambda$
$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$	$K = \;/\; E_k = \frac{1}{2}mv^2$	$T = \frac{1}{f}$
$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$	$E_m = K + U \;/\; E_m = E_k + E_p$	$E = hf$
$v_f^2 = v_i^2 + 2a\Delta x$		$E = \frac{hc}{\lambda}$

Electrostatic		Electric Circuits	
$n = \frac{Q}{e}$	$Q_{new} = \frac{Q_1 + Q_2}{2}$	$V = \frac{W}{Q}$	
		$V = IR$	
		$R_s = R_1 + R_2 + R_3$	
		$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	$R_p = \frac{R_1 R_2}{R_1 + R_2}$

DATA FOR PHYSICAL SCIENCES – GRADE 10 PAPER 2 (CHEMISTRY)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Avogadro's constant	N_A	$6{,}02 \times 10^{23}$ mol^{-1}
Standard pressure	p^{θ}	$1{,}013 \times 10^{5}$ Pa
Molar gas volume at STP	V_m	22,4 dm^3·mol^{-1}
Standard temperature	T^{θ}	273 K
Charge on electron	e	$1{,}6 \times 10^{-19}$ C

TABLE 2: FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$	$n = \frac{V}{V_m}$	$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$

TABLE 3: 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)
2,1 H 1																	2 He 4
1,0 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	1,6 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 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
0,7 Fr	0,9 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

KEY

