KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES

COMMON TEST

JUNE 2021

MARKS: 50

TIME : 1 hour

This question paper consists of 7 pages.

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 6 questions. Answer ALL questions in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub-questions, e.g. between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You are advised to use the attached DATA SHEET.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc where required.
10. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions.
Each question has only ONE correct answer. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.4) in the ANSWER BOOK, e.g. 1.5 D

1.1 The emf of a battery is the …

A energy supplied by the battery per coulomb of charge.
B energy supplied by the battery per unit current.
C potential difference across the terminals of the battery when delivering current.
D force exerted by the battery per unit charge. (2)

1.2 Which ONE of the following statements below regarding the AVERAGE velocity and the INSTANTANEOUS velocity of an object is TRUE? They are …

A always equal.
B never equal.
C only equal when the velocity is constant.
D only equal when the acceleration is constant. (2)

1.3 When a car accelerates at 5 $m \cdot s^{-2}$ it means that its…

A velocity changes by 5 $m \cdot s^{-1}$ every second.
B velocity changes by 5 $m \cdot s^{-1}$ for every 1metre travelled.
C acceleration changes by 5 $m \cdot s^{-2}$ for every one second.
D displacement increases by 5 m for every one second. (2)

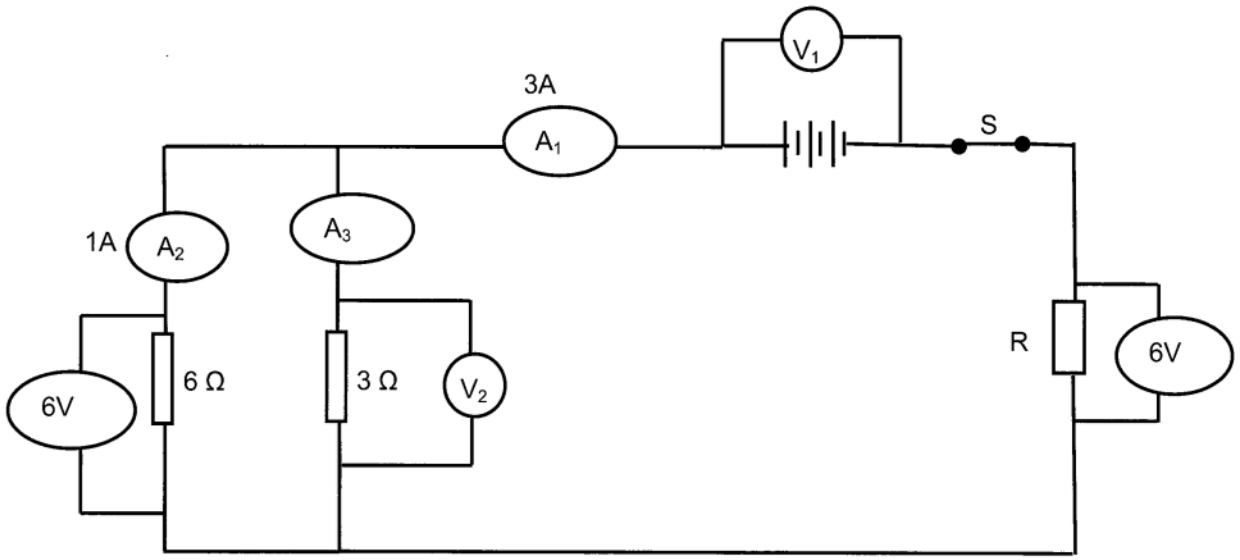
1.4 A car has a kinetic energy E when it is travelling at a constant velocity. When its velocity is doubled its new kinetic energy will now be ...

A $^1/_4E$
B $^1/_2E$
C 2E
D 4E (2)

[8]

QUESTION 2

Study the circuit diagram below. The readings on ammeters A_1 and A_2 are 3A and 1A respectively. The voltmeters connected across the 6Ω resistor and the resistor R both read 6V.



2.1 Define the term *current strength*. (1)

2.2 What is the reading on:

2.2.1 Ammeter A_3? (1)

2.2.2 Voltmeter V_2? (1)

2.2.3 Voltmeter V_1? (1)

2.3 Calculate the effective resistance for the resistors connected in parallel. (3)

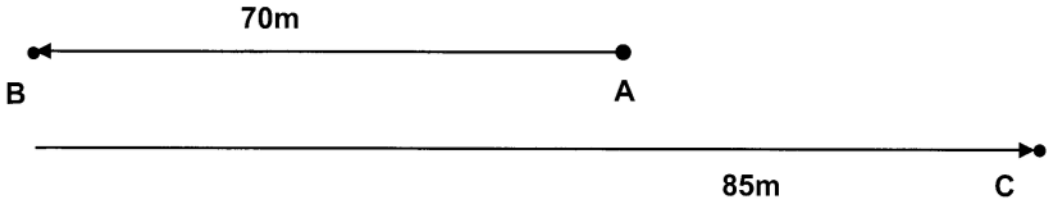
2.4 If the total resistance of the circuit is 4Ω, determine the resistance of resistor R. (2)

2.5 Calculate the quantity of charge that flows through resistor R in 2 minutes. (3)

2.6 Determine how much electrical work will be done by the battery in 2 minutes. (3)
[15]

QUESTION 3

A jogger starts at position A and runs 70m due west to position B. He then turns around and runs 85m due east to position C.



3.1 Define a *vector*. (1)

3.2 Determine his final displacement when using:

3.2.1 Position A as a reference point. (1)

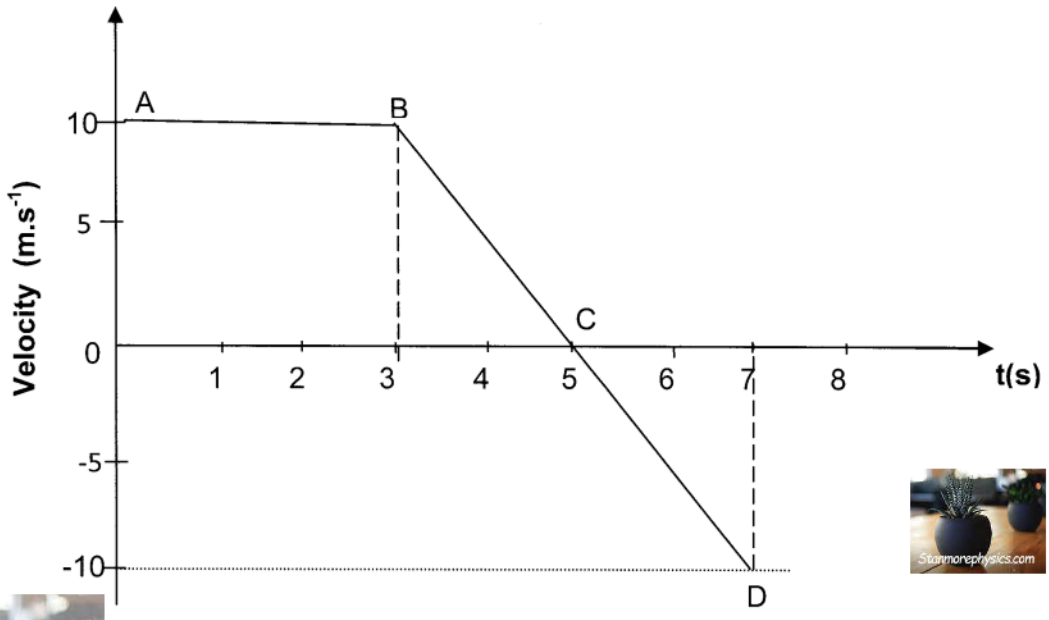
3.2.2 Position B as a reference point. (1)

3.3 Determine the total distance travelled by the jogger. (1)

[4]

QUESTION 4

The velocity versus time graph below illustrates the motion of an object that is initially travelling in an EASTERLY direction. Its initial position at time t=0 is taken as 0 m.



4.1 Describe the motion of the object during segment AB. (1)

4.2 In which direction is the object moving during segment BC? (EAST or WEST) (1)

4.3 Calculate the magnitude and direction of the acceleration during segment BD. (3)

4.4 Calculate the total distance travelled by the object from A to C. (2)

4.5. Calculate the object's average speed between A and C. (2)

4.6 As the object moves from B to C, describe the motion of the object from C to D. (2)

[11]

QUESTION 5

A motorist travelling due south at 30 $m \cdot s^{-1}$ applies brakes uniformly and takes 4 s to bring the car to a stop.

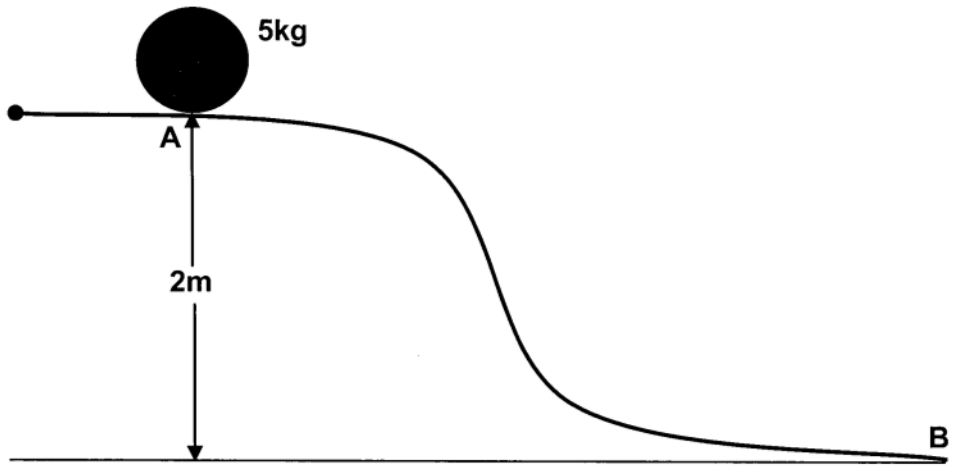
5.1 Define *acceleration.* (1)

5.2 Calculate the distance covered by the car when the brakes are applied. (3)

5.3 Determine the acceleration of the car when the brakes are applied. (3)

[7]

QUESTION 6



A 5kg ball starts from rest at position A that is at a vertical height of 2 m and rolls freely down a slope to position B. Ignore the effects of friction.

6.1 State the *law of conservation of mechanical energy* in words. (1)

6.2 Using the law of conservation of mechanical energy only, calculate the speed of the ball when it reaches position B. (4)

[5]

TOTAL : 50

DATA FOR PHYSICAL SCIENCES GRADE 10
JUNE 2021

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Electron charge	Q_e	$-1,6 \times 10^{-19}$ C
Acceleration due to gravity	g	9,8 m·s^{-2}

TABLE 2: FORMULAE

WAVES, SOUND AND LIGHT

$v = f\lambda$ **or** $c = f\lambda$	$T = \frac{1}{f}$	$E = hf$

ELECTROSTATICS

$n = \frac{Q}{Q_e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUIT

$Q = I\ \Delta t$	$\frac{1}{Rp} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
$R_s = R_1 + R_2 + ...$	$V = \frac{W}{Q}$

MOTION/*BEWEGING*

$v_f = v_i + a\,\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/*of* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/*of* $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ or/*of* $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

ENERGY

$E_p = mgh$ or $U = mgh$	$E_k = \frac{1}{2}mv^2$ or $K = \frac{1}{2}mv^2$

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MARKING GUIDELINE

MARKS: 50

TIME : 1 hour

This marking guideline consists of 4 pages.

SECTION A

QUESTION 1

1.1 A ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 D ✓✓ (2)
[8]

QUESTION 2

2.1 The rate of flow of charge ✓ (1)

2.2.1 2A✓ (1)

2.2.2. 6V✓ (1)

2.2.3 12 V✓ (1)

2.3 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{R_p} = \frac{1}{6} + \frac{1}{3}$ ✓

$R_p = 2\Omega$ ✓ (3)

2.4 $R_T = Rp + R_R$

$4 = 2 + R$ ← either one: 1 mark✓

$R_R = 2\Omega$ ✓ (2)

2.5 $I = \frac{Q}{\Delta t}$ ✓

$3 = \frac{Q}{120}$ ✓

$Q - 360C$ ✓ (3)

2.6 $W = VI\,\Delta t$ ✓

$= 12x3x120$ ✓

$= 4320J$ ✓

OR:

$W = VQ$ ✓

$= 12 \times 360$✓ $= 4320$ J✓

(3)
[15]

QUESTION 3

3.1. A physical quantity that has magnitude and direction✓ (1)

3.2.1. 15 m east ✓ (1)

3.2.2. 85 m east ✓ (1)

3.3 155 m ✓ (1)

[4]

QUESTION 4

4.1 Travels at constant velocity ✓ (1)

4.1.2. EAST ✓ (1)

4.3 $a = \frac{y_2 - y_1}{x_2 - x_1}$ or a = gradient } ✓

$= \frac{-10 - 10}{7 - 3}$ } ✓

$= -5 m.s^{-2}$

$= 5 m.s^{-2}$ west ✓ (3)

4.4 Distance = area under graph

$= (l \times b) + \left(\frac{1}{2} b \times h\right)$

$= (3 \times 10) + \left(\frac{1}{2} b \times 2 \times 10\right)$ } any one ✓

= 40 m ✓ (2)

4.5 $Speed = \frac{D}{\Delta t}$

$= \frac{40}{5}$ ✓

$= 8 m.s^{-1}$ ✓ (2)

4.6 Object turned around and started from rest. ✓ Travelled at constant acceleration to a velocity of 10 m.s-1 in 2 seconds✓ (2)

[11]

QUESTION 5

5.1 Rate of change of velocity✓ (1)

5.2 $\Delta x = \frac{V2 + V1}{2} \Delta t$

$= \frac{(0 + 20}{2} . 4$ ✓

$= 40m$ ✓ (3)

5.3 $v_f = v_2 + a\Delta t$ ✓

$0 = 30 + (a)(4)$ ✓

$a = -7,5\ m.s^{-2}$

$= \underline{7,5\ m.s^{-2}\ due\ north}$ ✓ (3)

[7]

QUESTION 6

6.1. In an isolated system. ✓the total mechanical energy remains constant ✓ (1)

6.2. E_M at A = E_M at B

(Ep + Ek) A = (Ep + E_k)B } any one ✓

$(5 \times 9,8 \times 20) + 0 = \left(\frac{1}{2} \times 5 \times v^2\right)$ ✓

$V = 19,80\ m.s^{-1}$ ✓ (4)

[5]

TOTAL MARKS: [50]