CONTROL TEST

GRADE 11

PHYSICAL SCIENCES

MARCH 2020

MARKS: 100

TIME: 2 HOURS

This paper consists of EIGHT 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 SIX 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.
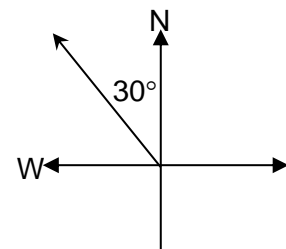
1.1 Which one of the following vector diagrams will produce the greatest resultant displacement?

(2)
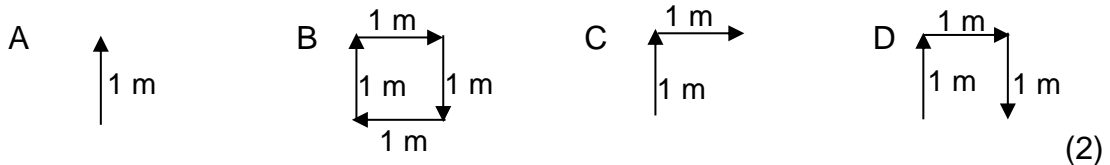
1.2 The diagram on the right shows the displacement of an object.

What is the direction of this displacement?

A   N30°W

B   W30°N

C   N30°E

D   E30°N   (2)

1.3 Which one of the following pairs is an example of a scalar quantity and a vector quantity?

A   Mass and acceleration

B   Acceleration and weight

C   Force and velocity

D   Mass and time   (2)

1.4 The physical quantity which is a measure of the resistance of an object to any change in its state of rest or motion is called …

A   acceleration.

B   friction.

C   weight.

D   mass.   (2)

1.5 Two balls, **P** and **Q**, are dropped simultaneously from the same height in a vacuum. Ball **P** has TWICE the mass of ball **Q**. Ignore the effects of air friction. Which statement is true?

A   Both balls will reach the ground at the same time.

B   Ball **Q** will reach the ground sooner than ball **P**.

C   Ball **P** will reach the ground sooner than ball **Q**.

D   Both balls will be suspended in the air.   (2)

1.6 A book rests on a horizontal table as shown in the diagram. The force *w* represents the weight of the book.
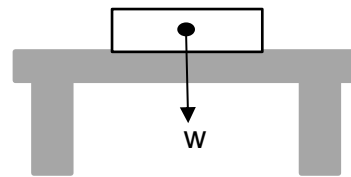
Which one of the following is part of the action-reaction force pair, according to *Newton's third law of motion*, of the WEIGHT of the book?

A   Force of book on table

B   Force of book on Earth

C   Force of table on book

D   Force of Earth on book   (2)

1.7 The mass of an astronaut on Earth is *M*. At a height equal to twice the radius of the earth above the earth, the mass of the astronaut is …

A $\frac{1}{4}$M.

B $\frac{1}{2}$M.

C   2M.

D   M.   (2)

1.8 The type of chemical bond in which an ion shares a lone pair of electrons of a molecule is called …

A   a dative covalent bond.

B   a covalent bond.

C   a metallic bond.

D   an ionic bond.   (2)

1.9 What is the shape of boron fluoride according to the VSEPR theory?

    A   Trigonal bipyramidal

    B   Trigonal pyramidal

    C   Trigonal planar

    D   Tetrahedral   (2)

1.10 What happens to bond length and bond strength if the number of bonds between two atoms increase?

	Bond length	Bond strength
A	Decreases	Increases
B	Increases	Increases
C	Decreases	Decreases
D	Unchanged	Increases

(2)
[20]

QUESTION 2

Consider the diagram on the right. It shows three forces of 5 N, 8 N and 9,19 N acting on an object in the same Cartesian plane.

Assume that the y-axis is also the north-south line.
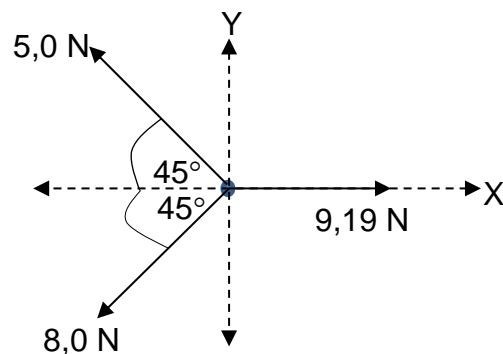
2.1 Define the term *vector* in words. (2)

2.2 Use the COMPONENT METHOD to calculate the MAGNITUDE of the RESULTANT of 5 N and 8 N. (6)

2.3 Calculate the DIRECTION of the resultant of 5 N and 8 N. Give the answer in terms of BEARING. (3)

2.4 The horizontal component of the resultant calculated in question 2.2 is equal and opposite to the 9,19 N force. Why are these two forces NOT considered to be an action–reaction force pair according to *Newton's third law of motion*? (2)
**[13]**

QUESTION 3

A and **B** are two trolleys made of the SAME MATERIAL. Their masses are 5 kg and 10 kg respectively, and they are connected by an inextensible rope of negligible mass. **A** and **B** REMAIN STATIONARY on a rough, horizontal surface when a horizontal force of 50 N is applied to trolley **B**. The trolleys are therefore in *equilibrium*.
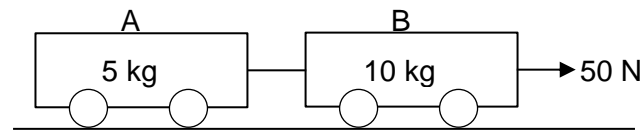
3.1 Explain the term *equilibrium* in physics by referring to forces. (2)

3.2 State *Newton's first law of motion* in words. (2)

3.3 Show by means of a calculation that the coefficient of friction is equal to 0,34. (3)

The angle at which the 50 N force is applied, is increased to 30° with reference to the horizontal as shown below. Despite the fact that the magnitude of the applied force remains 50 N, the trolleys ACCELERATE to the right at *a*. The coefficient of friction now changes to 0,32.
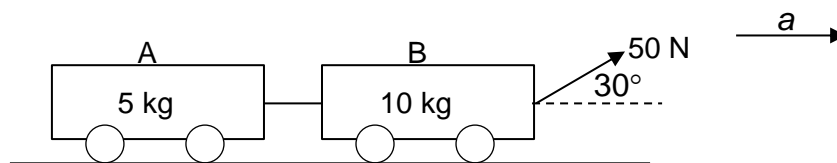
3.4 State *Newton's second law of motion* in words. (3)

3.5 Draw a labelled free-body diagram for all the forces acting on trolley **B**. Please note that components of forces may not be used in the diagram. (5)

3.6 Calculate the magnitude of the:

3.6.1 Normal force on trolley **B** (4)

3.6.2 Acceleration of the trolleys (7)

3.6.3 Tension in the rope between the two trolleys (2)

[28]

QUESTION 4

Block **P**, mass 2 kg, is connected to block **Q**, mass 3 kg, by a light, inextensible string. Both blocks are on a plane inclined at an angle of 30° to the horizontal.

Block **Q** is pulled by a constant force of 36,25 N up the incline. This force is also parallel to the incline.

Block **P** moves on a rough section, **AB**, of the incline, while block **Q** moves on a frictionless section, **BC**, of the incline. See diagram below.
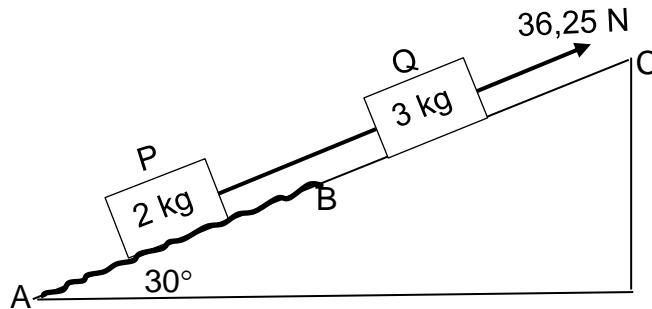
A constant frictional force of 2,5 N acts on block **P** as it moves from **A** to **B** up the incline.

4.1 Calculate the coefficient of friction between the surface and the 2 kg block. (4)

4.2 Calculate the magnitude of the acceleration of block **P** while it is moving on section **AB**. (6)

4.3 Does the acceleration of block **P**, as calculated in question 4.2, INCREASE, REMAIN THE SAME or DECREASE once it is beyond point **B** (in other words, when it is moving on section **BC** like block **Q**)? Give a reason for your answer. (2)

[12]

QUESTION 5

A communication satellite, mass 350 kg, orbits the earth with a speed v as shown in the diagram. The earth exerts a gravitational force of 175 N on the satellite.

M r v $m = 350$ kg
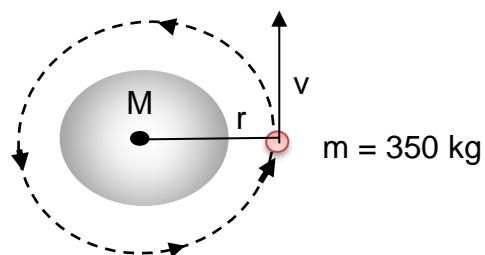
5.1 State *Newton's law of universal gravitation* in words. (2)

5.2 Brian argues that the earth exerts a stronger force on the satellite compared to the satellite's force on the earth, because the earth has a larger mass. NAME and STATE the law in words that you can use to clarify Brian's misconception. (3)

5.3 Calculate the height of the satellite above the surface of the earth. (5)

[10]

QUESTION 6

6.1 Define the term *electronegativity*. (2)

6.2 Chemical bonding take place between atoms to form molecules. What TYPE of chemical bond take place between the following atoms to form their molecules?

6.2.1 Fluorine atoms to form F_2. (1)

6.2.2 Hydrogen and fluorine to form HF. (1)

6.2.3 Classify each of F_2 and HF as polar or non-polar molecules. (2)

6.2.4 Show calculations to verify your answers to questions 6.2.1–6.2.3. (3)

6.3 Hydrogen reacts with carbon to form methane (CH_4) and ethyne (C_2H_2) molecules. Use Lewis structure to:

6.3.1 Show the FORMATION of ethyne from carbon and hydrogen. (4)

6.3.2 Represent a methane molecule. (2)

6.4 Use the VSEPR theory to identify the shapes of CH_4 and C_2H_2 (2)

[17]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 11
MARCH CONTROL TEST

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
MAART KONTROLETOETS

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

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Acceleration due to gravity *Swaartekragvernelling*	g	$9,8 \text{ m·s}^{-2}$
Gravitational constant *Swaartekragkonstatnte*	G	$6,67 \times 10^{-11} \text{ N·m}^2\text{·kg}^{-2}$
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^9 \text{N·m}^2\text{·C}^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10\text{-}11 \text{ m·s}^{-1}$
Charge of electron *Lading op elektron*	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31} \text{ kg}$
Mass of Earth *Massa van Aarde*	M	$5,98 \times 10^{24} \text{ kg}$
Radius of Earth *Radius van Aarde*	R_E	$6,38 \times 10^6 \text{ m}$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

MOTION / *BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \dfrac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x = \left[\dfrac{v_f + v_i}{2}\right]\Delta t$

FORCE / *KRAG*

$F_{net} = ma$	$w = mg$
$F = \dfrac{Gm_1m_2}{r^2}$	$f_s^{max/maks} = \mu_s N$
	$f_k = \mu_k N$

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)
1 $\,^{2,1}$ **H** 1																	2 **He** 4
3 $\,^{1,0}$ **Li** 7	4 $\,^{1,5}$ **Be** 9											5 $\,^{2,0}$ **B** 11	6 $\,^{2,5}$ **C** 12	7 $\,^{3,0}$ **N** 14	8 $\,^{3,5}$ **O** 16	9 $\,^{4,0}$ **F** 19	10 **Ne** 20
11 $\,^{0,9}$ **Na** 23	12 $\,^{1,2}$ **Mg** 24											13 $\,^{1,5}$ **Aℓ** 27	14 $\,^{1,8}$ **Si** 28	15 $\,^{2,1}$ **P** 31	16 $\,^{2,5}$ **S** 32	17 $\,^{3,0}$ **Cℓ** 35,5	18 **Ar** 40
19 $\,^{0,8}$ **K** 39	20 $\,^{1,0}$ **Ca** 40	21 $\,^{1,3}$ **Sc** 45	22 $\,^{1,5}$ **Ti** 48	23 $\,^{1,6}$ **V** 51	24 $\,^{1,6}$ **Cr** 52	25 $\,^{1,5}$ **Mn** 55	26 $\,^{1,8}$ **Fe** 56	27 $\,^{1,8}$ **Co** 59	28 $\,^{1,8}$ **Ni** 59	29 $\,^{1,9}$ **Cu** 63,5	30 $\,^{1,6}$ **Zn** 65	31 $\,^{1,6}$ **Ga** 70	32 $\,^{1,8}$ **Ge** 73	33 $\,^{2,0}$ **As** 75	34 $\,^{2,4}$ **Se** 79	35 $\,^{2,8}$ **Br** 80	36 **Kr** 84
37 $\,^{0,8}$ **Rb** 86	38 $\,^{1,0}$ **Sr** 88	39 $\,^{1,2}$ **Y** 89	40 $\,^{1,4}$ **Zr** 91	41 **Nb** 92	42 $\,^{1,8}$ **Mo** 96	43 $\,^{1,9}$ **Tc**	44 $\,^{2,2}$ **Ru** 101	45 $\,^{2,2}$ **Rh** 103	46 $\,^{2,2}$ **Pd** 106	47 $\,^{1,9}$ **Ag** 108	48 $\,^{1,7}$ **Cd** 112	49 $\,^{1,7}$ **In** 115	50 $\,^{1,8}$ **Sn** 119	51 $\,^{1,9}$ **Sb** 122	52 $\,^{2,1}$ **Te** 128	53 $\,^{2,5}$ **I** 127	54 **Xe** 131
55 $\,^{0,7}$ **Cs** 133	56 $\,^{0,9}$ **Ba** 137	57 **La** 139	72 $\,^{1,6}$ **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	81 $\,^{1,8}$ **Tℓ** 204	82 $\,^{1,8}$ **Pb** 207	83 $\,^{1,9}$ **Bi** 209	84 $\,^{2,0}$ **Po**	85 $\,^{2,5}$ **At**	86 **Rn**
87 $\,^{0,7}$ **Fr**	88 $\,^{0,9}$ **Ra** 226	89 **Ac**															

KEY/SLEUTEL

Atomic number / *Atoomgetal* → 29

Electronegativity / *Elektronegatiwiteit* → 1,9 **Cu** ← Symbol / *Simbool*

63,5 ← Approximate relative atomic mass / *Benaderde relatiewe atoommassa*

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**