education

Department of Education
FREE STATE PROVINCE

PROVINCIAL CONTROL TEST

GRADE 11

PHYSICAL SCIENCES

MARCH 2017

MARKS: 100

TIME: 2 HOURS

This paper consists of ten pages and three information 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 SEVEN (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 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 only the letter A, B, C and D next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 A person in a vehicle falls to the right when the vehicle makes a sudden turn to the left. This can be explained by ...

A Newton's first law of motion.

B Newton's second law of motion.

C Newton's third law of motion.

D Newton's law of universal gravitation. (2)

1.2 A rifle recoils when a bullet is fired. This can be explained by ...

A Newton's first law of motion.

B Newton's second law of motion.

C Newton's third law of motion.

D Newton's law of universal gravitation. (2)

1.3 Three forces F_1, F_2 and F_3 acting on an object, are in equilibrium. Which one of the following is a correct representation for this?

(2)

1.4 Two forces with magnitudes of 5 N and 7 N act simultaneously on the same object. The angle between the two forces can be changed. Which one of the following CANNOT be a resultant for the two forces?

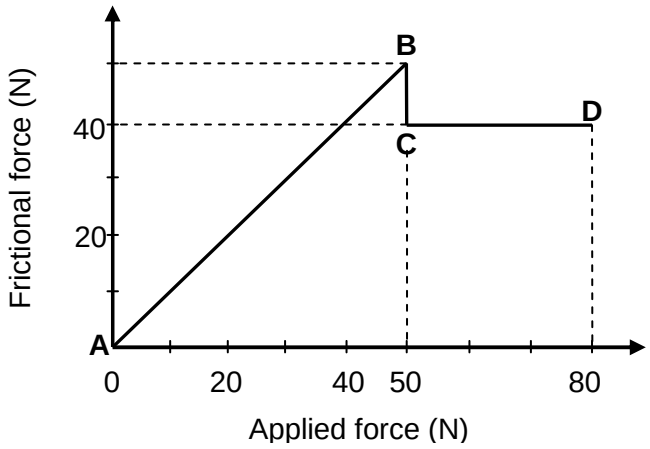
A 2 N

B 4 N

C 12 N

D 14 N (2)

1.5 The graph below represents the relationship between the frictional force and the applied force on an object that is initially at rest on a rough, HORIZONTAL surface.



Which section of the graph represents static friction?

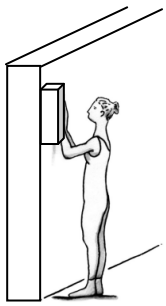
A AB

B BC

C AC

D CD (2)

1.6 A girl holds a book stationary against a wall as shown below. She applies a perpendicular force on the book, in the direction of the wall, with her hands.



According to Newton's third Law of motion, the reaction force for the force of the girl's hands on the book is the ...

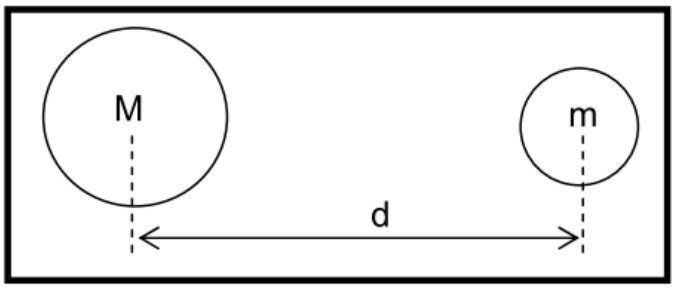
A book's weight.

B normal force on the book.

C force of friction on the book.

D force of the book on the girl's hands. (2)

1.7 Two small objects with masses *M* and *m* are separated by a distance *d* between their centres. Each object exerts a gravitational force *F* on the other one. Distance d is much larger than the dimensions of the objects.



What gravitational force would be exerted if the masses change to 2*M* and 4*m* and the distance to ½*d*?

A $\frac{F}{2}$

B 2 F

C 16 F

D 32 F (2)

1.8 Which one of the following pairs of atoms is most likely to form a POLAR covalent bond?

A Carbon and fluorine

B Sodium and fluorine

C Fluorine and fluorine

D Sodium and sodium (2)

1.9 The molecular shape of a molecule with the formula AX_3 is …

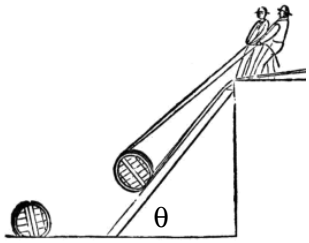
A linear.

B tetrahedral.

C trigonal planar.

D trigonal bipyramidal. (2)

1.10 A wine barrel, weight *w*, is being pulled upwards by two men at a CONSTANT speed along a plane inclined at an angle θ with the horizontal, as shown below. Ignore friction. Assume that the pulling force exerted by the men on the barrel is PARALLEL to the inclined plane and that θ is less than 45°.



Which one of the following expressions gives the magnitude of the pulling force by the men on the barrel?

A $w\sin\theta$

B $w\cos\theta$

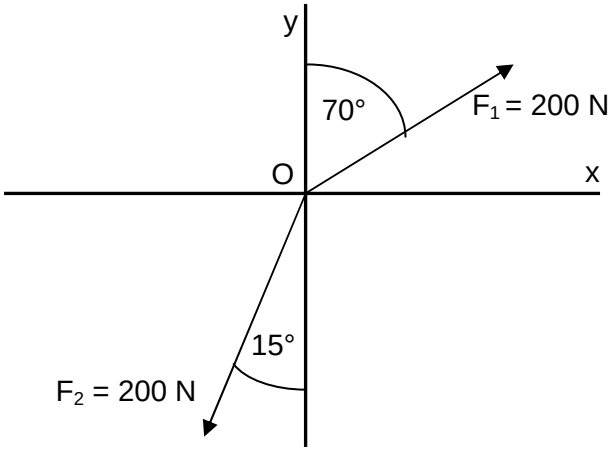
C $\frac{w}{\cos\theta}$

D $\frac{w}{\sin\theta}$ (2)

[20]

QUESTION 2

In the sketch below forces F_1 and F_2 act on the same object at point **O** as shown. Forces F_1 and F_2 each has a magnitude of 200 N.



2.1 Define the term *resultant*. (2)

2.2 Use a SCALE DRAWING to determine the components of force F_2. Use a scale where 10 mm represents 40 N. (4)

2.3 CALCULATE the components of force F_1. (4)

2.4 Use your answers to QUESTIONS 2.2 and 2.3 to CALCULATE the magnitude and direction of the RESULTANT of F_1 and F_2. Express the direction as an angle with respect to the positive x-axis. (6)
[16]

QUESTION 3

A force of 50 N is applied to a cement block, mass 40 kg, which is AT REST on a ROUGH, horizontal surface. The force makes an angle of 40° with the horizontal and the block is ON THE VERGE of moving.

3.1 Define the term *frictional force.* (2)

3.2 Draw a FORCE DIAGRAM, with labels, showing ALL the forces acting on the block. (4)

3.3 Calculate the magnitude of the:

3.3.1 Normal force (4)

3.3.2 Frictional force which acts on the cement block (3)

3.3.3 Coefficient of static friction (3)

3.4 The angle between the 50 N force and the horizontal is decreased to 30°. How will each of the following change (write only INCREASE, DECREASE or REMAIN THE SAME)?

3.4.1 Normal force (2)

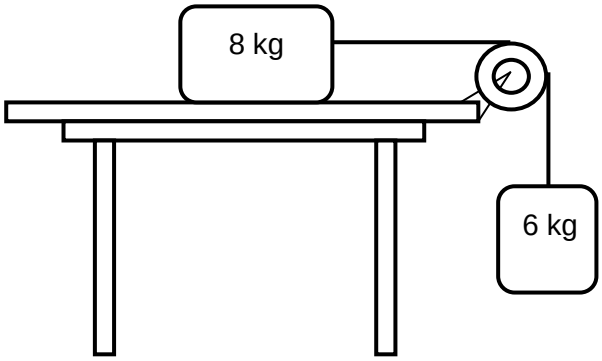
3.4.2 Force of friction (2)

3.4.3 Coefficient of static friction (2)

[22]

QUESTION 4

An 8 kg cement block on a rough, horizontal surface is connected to a 6 kg object by means of a light, inextensible string, running over a light, frictionless pulley. The kinetic coefficient of friction for the cement block and the table is 0,3 when the 6 kg object is released and starts to move downwards.



4.1 Write down *Newton's second law of motion* in words. (3)

4.2 Draw free body diagrams, with labels, to show ALL the forces acting on the 8 kg block and on the 6 kg object. (6)

4.3 Use simultaneous equations for the two objects to calculate the magnitude of their acceleration. (6)

[15]

QUESTION 5

The International Space Station (ISS), with a mass of 420 000 kg, is in orbit around the earth.

5.1 Write down *Newton's law of universal gravitation* in words. (3)

5.2 Calculate the distance between the centres of the earth and the ISS if the earth exerts a force of $3,64 \times 10^6$ N on the ISS to keep it in orbit. Express your final answer in kilometre. (5)

[8]

QUESTION 6

Ammonia (NH_3) is an important gas that is used in the preparation of fertilizers. An ammonia molecule is formed when electrons are shared between three hydrogen atoms and one nitrogen atom.

6.1 Name the type of chemical bond which forms between one hydrogen atom and one nitrogen atom. (1)

6.2 Define the term v*alence electrons*. (2)

6.3 How many valence electrons does one nitrogen atom have? (1)

6.4 For the ammonia molecule:

6.4.1 Draw the Lewis structure of one ammonia molecule. (2)

6.4.2 How many electron pairs surround the central atom? (1)

6.4.3 How many atoms surround the central atom? (1)

6.4.4 Give the term that is used to describe the molecular shape. (1)

6.5 Ammonia readily dissolves in water (H_2O) to form ammonium ions (NH_4^+).

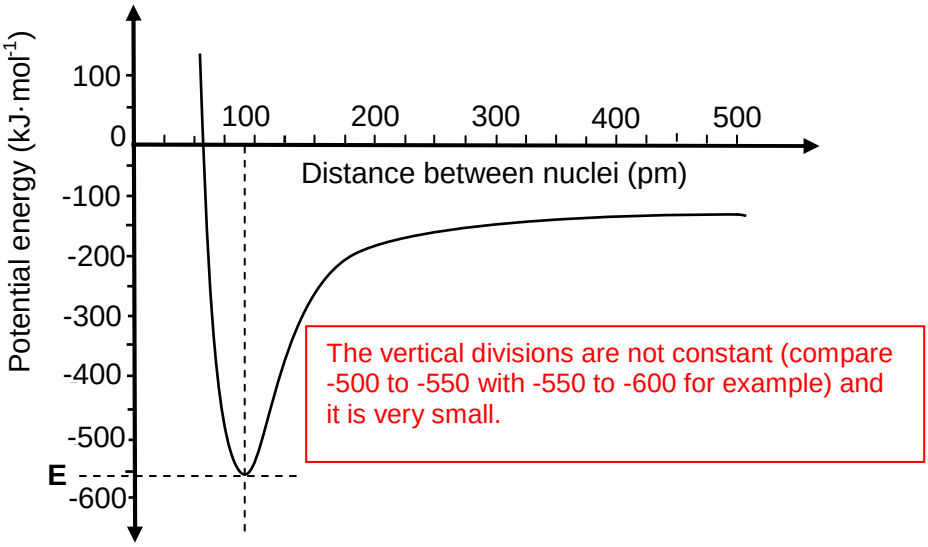
6.5.1 Name the type of bond that forms between one ammonia molecule and one hydrogen ion. (1)

6.5.2 Draw the Lewis structure of one ammonium ion. (2)

[12]

QUESTION 7

The graph below shows the change in energy that takes place when a hydrogen atom (H) approaches a fluorine atom (F).



7.1 Define the term *bond length.* (2)

7.2 Write down the following by using the graph:

7.2.1 Bond length, in pm, of the H-F bond (1)

7.2.2 Energy, in kJ·mol^{-1}, needed to break the H-F bond. (1)

7.2.3 Name of the potential energy represented by **E**. (1)

7.3 How will the bond energy of an H-Cℓ bond compare to that of the H-F bond? Write down EQUAL TO, LESS THAN or MORE THAN. Give a reason for your answer. (2)

[7]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 11 (PHYSICS)
CONTROL TEST - TERM 1

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (FISIKA)
KONTROLETOETS - KWARTAAL 1

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

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

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

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

FORCE / *KRAG*

$F_{net} = ma$	$p = mv$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$F = \frac{Gm_1m_2}{r^2}$ $\quad$ $g = \frac{GM}{r^2}$
$\mu_s = \frac{f_{s(max)}}{N}$ / $\mu_s = \frac{f_{s(maks)}}{N}$	$\mu_k = \frac{f_k}{N}$

WEIGHT AND MECHANICAL ENERGY / *GEWIG EN MEGANIESE ENERGIE*

$w = mg$ or/*of* $F_g = mg$	$U = mgh$ or/*of* $E_p = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	

DATA FOR PHYSICAL SCIENCES GRADE 11 (CHEMISTRY)
CONTROL TEST - TERM 1

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (CHEMISTRY)
KONTROLETOETS - KWARTAAL 1

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

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Avogadro's constant *Avogadrokonstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4\ dm^3 \cdot mol^{-1}$
Standard pressure *Standaarddruk*	p^θ	$1{,}013 \times 10^5\ Pa$
Standard temperature *Standaardtemperatuur*	T^θ	273 K
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Molar gas constant *Molêre gaskonstante*	R	$8{,}31\ J \cdot K^{-1} \cdot mol^{-1}$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$pV = nRT$
$n = \frac{m}{M}$	$c = \frac{n}{V}$
$c = \frac{m}{MV}$	$\frac{n_a}{n_b} = \frac{c_aV_a}{c_bV_b}$ / $\frac{n_s}{n_b} = \frac{c_sV_s}{c_bV_b}$

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)
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 55 Cs 133	0,9 56 Ba 137	57 La 139	1,6 72 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 81 Tℓ 204	1,8 82 Pb 207	1,9 83 Bi 209	2,0 84 Po	2,5 85 At	86 Rn
0,7 87 Fr	0,9 88 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	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

KEY/*SLEUTEL*