education

Department of Education
FREE STATE PROVINCE

GRADE 11
PROVINCIAL FORMAL ASSESSMENT TASK

MARCH 2015

PHYSICAL SCIENCES
CONTROL TEST

TIME: 2 HOURS

MARKS: 100

This paper consists of 8 pages and 3 information sheets.

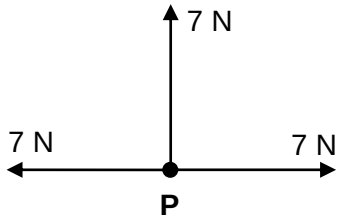
INSTRUCTIONS AND INFORMATION

1. Write your name and grade on the ANSWER BOOK.
2. This question paper consists of SEVEN 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 subsections, for example between QUESTION 2.1 and QUESTION 2.2.
6. Show ALL formulae and substitutions in ALL calculations.
7. You may use a non-programmable calculator.
8. You may use appropriate mathematical instruments.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEETS.
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. Write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, for example 1.11 D.

1.1 Three forces, each of magnitude 7 N, act on object **P** as shown.



The resultant force on object **P** is …

A zero.

B 7 N to the left.

C 7 N upwards.

D 7 N downwards. (2)

1.2 Two forces of magnitude 50 N and 70 N respectively act on a body. The maximum magnitude of the resultant force on the body is ...

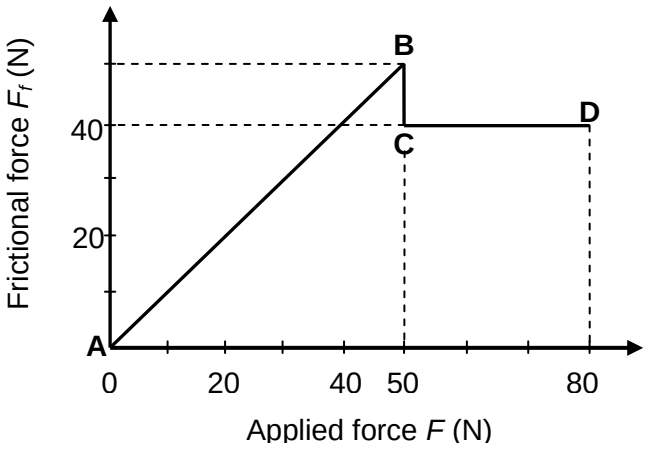
A 20 N.

B 60 N.

C 120 N.

D 140 N. (2)

1.3 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 the object at rest?

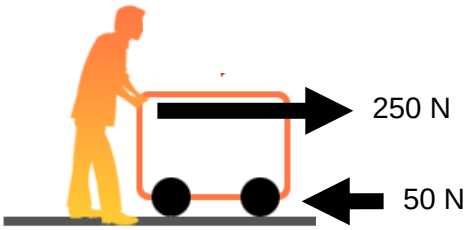
A AB

B BC

C CD

D BD (2)

1.4 A man applies a force of 250 N on a trolley as shown below. A frictional force of 50 N acts on the trolley. The trolley accelerates at 2 $m \cdot s^{-2}$ in the direction of the applied force.



According to Newton's Third Law of Motion, the magnitude of the reaction force exerted by the trolley on the man is …

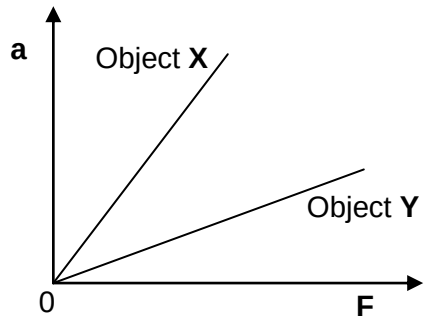
A 0 N.

B 200 N.

C 250 N.

D 300 N. (2)

1.5 The acceleration versus resultant force graphs for the motion of objects **X** and **Y** are shown below.



Which ONE of the following statements is TRUE?

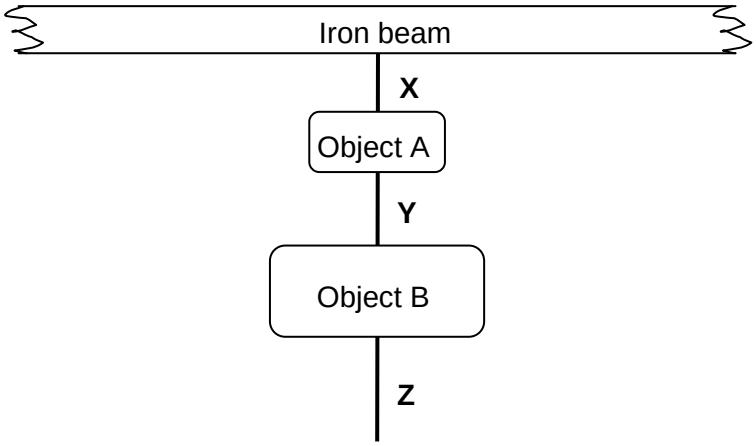
A Object **X** has a greater mass than object **Y**.

B For the same resultant force, object **X** has a smaller acceleration than object **Y**.

C If both objects experience the same acceleration, the resultant force on object **X** is greater than that on object **Y**.

D The gradient of the graph representing object **X** is the inverse of the mass of object **X**. (2)

1.6 Two objects, **A** and **B**, joined by rope **Y**, are attached to an iron beam with rope **X**. Rope **Z** is attached to object **B** as shown below. The ropes are adequately strong enough to hold the objects.



When rope **Z** is quickly pulled, it breaks below object **B**.

Which ONE of the following laws best explains why rope **Z** breaks and not ropes **X** or **Y**?

A Newton's Law of Universal Gravitation

B Newton's First Law of Motion

C Newton's Second Law of Motion

D Newton's Third Law of Motion (2)

1.7 A boy with mass of 50 kg stands on a Newton scale in an elevator. If the reading on the scale is larger than 500 N, the elevator …

A accelerates downwards.

B accelerates upwards.

C moves downwards at a constant velocity.

D moves upwards at a constant velocity. (2)

1.8 An object attracts another object with a gravitational force of magnitude *F*. The distance between the centres of the two objects is now decreased to a THIRD of the original distance. The force of attraction that the one object now exerts on the other object is:

A $\frac{1}{9}F$

B $\frac{1}{3}F$

C $3F$

D $9F$ (2)

1.9 Which ONE of the following compounds has covalent bonds between particles?

A Li_2O

B NaCℓ

C NO_2

D MgF_2 (2)

1.10 Which ONE of the following correctly gives the relationship between bond length and bond energy?

As bond length decreases, bond energy ...

A decreases.

B increases.

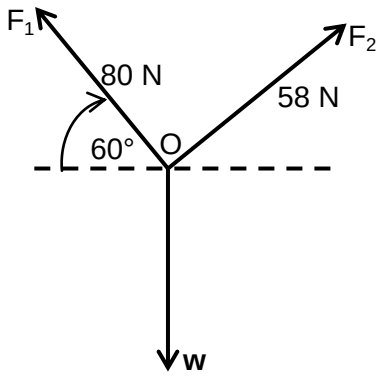
C remains the same.

D increases and then decreases. (2)

[20]

QUESTION 2

Three forces, **F_1**, **F_2** and **w**, act on point **O** as shown in the diagram below.



2.1 Define the term *resultant of forces*. (2)

2.2 By means of an accurate scale drawing, determine the vertical component of **F_1**. Use a scale where 10 N is represented by 10 mm. (5)

2.3 The horizontal and vertical components of **F_2** are equal to 40 N and 42 N respectively.

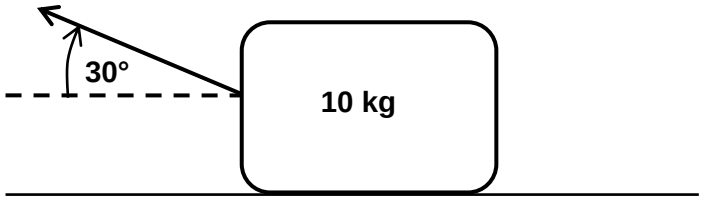
2.3.1 Prove with calculations that the horizontal components of the forces are in equilibrium. (3)

2.3.2 Calculate the magnitude and direction of force **w**. (2)

[12]

QUESTION 3

A 10 kg cement block is pulled across the floor with a force of 50 N, at an angle of 30° with the horizontal. The block accelerates at 1,5 $m \cdot s^{-2}$.



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

3.2 Draw a FORCE DIAGRAM showing ALL the forces acting on the object. (4)

3.3 Calculate the magnitude of the:

3.3.1 Normal force (3)

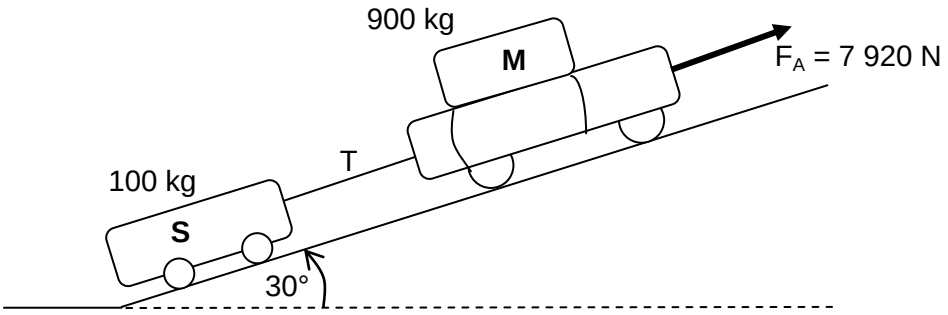
3.3.2 Frictional force which acts on the crate (5)

3.3.3 Coefficient of kinetic friction (4)

[18]

QUESTION 4

Car **M**, with a mass of 900 kg, tows trailer **S**, of mass 100 kg, up a slope of 30° with the horizontal as shown in the diagram below. The engine of the car exerts a force of 7 920 N. The car and the trailer experience kinetic frictional forces of 1 800 N and 200 N respectively. The rope connecting the car with the trailer is inelastic and of negligible mass.



4.1 Draw a labelled free body diagram showing ALL the forces acting on car **M**. (5)

4.2 Calculate the magnitude of the tension **T** in the rope if the system ACCELERATES up the slope at 3 $m \cdot s^{-2}$. (5)

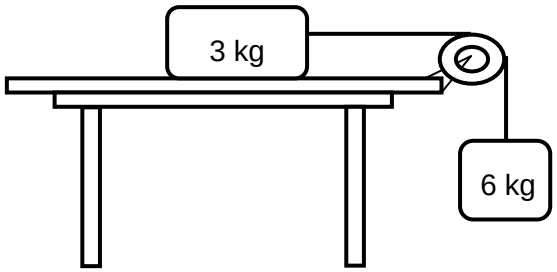
4.3 The car suddenly comes to a stop and a passenger in the car who is not wearing his safety belt continues to move forward.

Write down the name of the law of motion that explains why the passenger continues to move forward. (1)

[11]

QUESTION 5

In the diagram below, a 3 kg mass on a rough horizontal surface is joined to a 6 kg mass by a light, inextensible string running over a frictionless pulley. The coefficient of kinetic friction between the 3 kg mass and the surface is 0,34.



5.1 State *Newton's Second Law of Motion* in words. (3)

5.2. Draw a labelled free body diagram for the 6 kg block. (2)

5.3 Use Newton's Second Law of Motion and write down an equation that relates the

5.3.1 Forces on the 3 kg block with its mass and acceleration (4)

5.3.2 Forces on the 6 kg block with its mass and acceleration (3)

5.4 Use the two equations in QUESTION 5.3.1 and QUESTION 5.3.2 to determine tension **T**, in the string. (3)
[15]

QUESTION 6

The organisation Mars One will establish a permanent human settlement on Mars. Crews, consisting of four members, will depart every two years, starting in 2024. A lot of questions must be answered before then. The mass of Mars is $6{,}42 \times 10^{23}$ kg and its radius is $3{,}4 \times 10^{6}$ m.

6.1 State *Newton's Law of Universal Gravitation* in words. (3)

6.2 Calculate the magnitude of the gravitational accelaration on Mars. (4)
[7]

QUESTION 7

Ammonia reacts readily with water to form ammonium ions according to the following equation:

$$NH_3(aq) + H_2O(\ell) \rightarrow NH_4^+(aq) + OH^-(aq)$$

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

7.2 Write down the number of valence electrons in an atom of:

7.2.1 Oxygen (1)

7.2.2 Nitrogen (1)

7.3 For the water molecule, write down the:

7.3.1 Type of chemical bond formed between its atoms (1)

7.3.2 Number of electron pairs surrounding the central atom (1)

7.3.3 Number of atoms surrounding the central atom (1)

7.3.4 Name used to describe the molecular shape (1)

7.4 For the ammonia molecule, write down the:

7.4.1 Number of electron pairs surrounding the central atom (1)

7.4.2 Number of atoms surrounding the central atom (1)

7.4.3 Name used to describe the molecular shape (1)

7.5 An ammonium ion is formed when an ammonia molecule shares a lone pair of electrons with a hydrogen ion.

7.5.1 Name the type of bond formed between an ammonia molecule and a hydrogen ion. (1)

7.5.2 Represent the formation of an ammonium ion with the aid of Lewis structures. (4)

7.5.3 Write down the name used to describe the molecular shape. (1)
[17]

GRAND TOTAL: 100

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

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (FISIKA)
KONTROLETOETS – MARCH 2015

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

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}$ $m \cdot s^{-1}$
Gravitational constant *Swaartekragkonstante*	G	$6,67 \times 10^{-11}$ $N \cdot m^{2} \cdot kg^{-2}$
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9}$ $N \cdot m^{2} \cdot C^{-2}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}$ C
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}$ kg
Permittivity of free space *Permittiwiteit van vry ruimte*	ε_0	$8,85 \times 10^{-12}$ $F \cdot m^{-1}$

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 – MARCH 2015

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 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 87	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	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*