ALEXANDER ROAD HIGH SCHOOL

MARCH 2019 | 60 MIN

PHYSICAL SCIENCE CONTROL TEST 2

JA / CO | TOTAL = 60

GRADE 11

Instructions

- The question paper consists of 4 questions.
- Answer all the questions.
- Answer section A on the answer sheet provided AND section B on folio sheets.
- A non-programmable calculator may be used.
- Number the answers correctly according to the numbering system.
- Round off to two (2) decimal places where necessary.
- Formulas have been included on the reverse side of the answer sheet.
- A periodic table is attached.

SECTION A

Answer on the answer sheet -

QUESTION 1: Multiple choice

Four possible options are provided as answers to the following questions. Each question has only 1 correct answer. Choose the correct answer and write the letter (A – D) next to the relevant question number (1.1 – 1.10) on the answer sheet.

1.1 If an object is taken from the earth to the moon, the acceleration due to gravity it experiences on the surface of the moon is less than that which it experiences on the surface of the earth. Which one of the following statements explains this phenomenon?

A The object is far from the earth.

B There is no atmosphere on the moon.

C The radius of the moon is greater than that of the earth.

D The mass of the moon is less than that of the earth.

1.2 The force between two electrostatic charges is 0,2N. If one of the charges is doubled and the other charge is tripled, and the force between them changes to 0,6N, what is the relationship between the original distance (r_1) and the new distance (r_2) between the two charges?

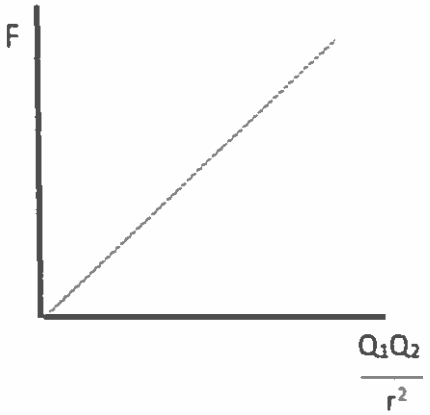
A $r_1^2 = 2 \times r_2^2$

B $r_1 = r_2$

C $r_2^2 = 2 \times r_1^2$

D $r_2 = \pm\sqrt{2 \times r_1}$

1.3 A scientist does an experiment to investigate the relationship between the electrostatic force (F) between two point charges (Q_1 and Q_2) and the size of the charges as well as the distance (r) between them. She obtains the following graph:



The gradient of the graph will be:

A $6{,}38 \times 10^{6}$ m

B $6{,}67 \times 10^{-11}$ N.m^2.kg^{-2}

C $9{,}0 \times 10^{9}$ N.m^2.C^{-2}

D It depends on which planet the scientist conducts the experiment.

1.4 Two masses, m_1 and m_2, are used in an investigation. A graph of gravitational force (F) vs $m_1 \times m_2$ will have a gradient of:

A G **B** Gr^2 **C** $\frac{1}{G}$ **D** $\frac{G}{r^2}$

1.5 The 3 laws that, respectively, explain the relationship between:

(i) Net force, acceleration and mass

(ii) Electrostatic repulsion between like charges, their individual charges and distance between the charges

(iii) The action-reaction forces between 2 objects

A (i) Newton 2, (ii) Newton's universal law of gravitation, (iii) Newton 3

B (i) Newton 2, (ii) Coulomb's law, (iii) Newton 3

C (i) Newton 1, (ii) Coulomb's universal law of gravitation, (iii) Newton 3

D (i) Newton 3, (ii) Coulomb's law of electrostatics, (iii) Newton 2

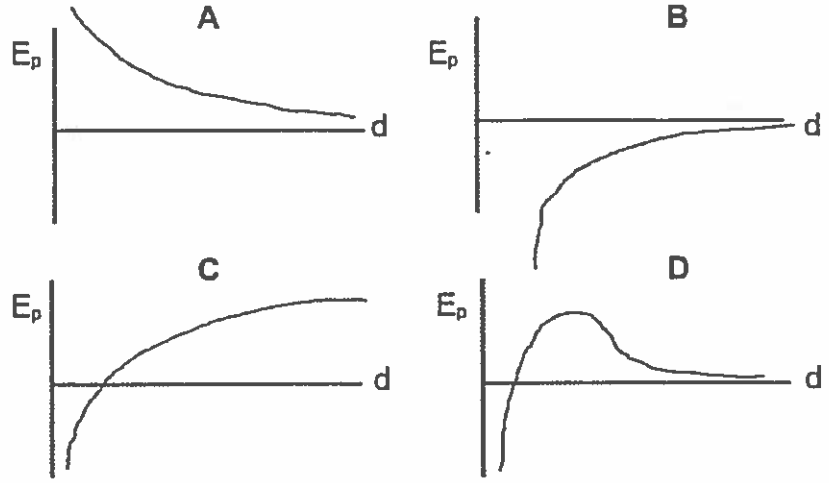
1.6 Match the molecule and shape. Which combination is correct?

	Molecule	**Molecule shape**
A	CCl_4	tetrahedral
B	PCl_5	pyramidal
C	BF_3	planar
D	NH_3	pyramidal

1.7 The bond strength between atoms in a hydrogen molecule is different to the bond strength in an oxygen molecule, because...

	Hydrogen	Oxygen	Difference
A	Small atoms	Larger atoms	Oxygen stronger
B	Single bond	Double bond	Oxygen stronger
C	Double bond	Single bond	Oxygen stronger
D	Large atoms	Smaller atoms	Hydrogen stronger

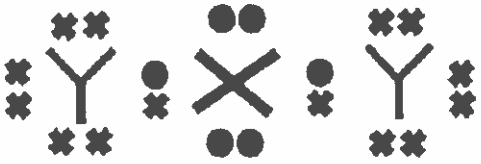
1.8 When two of the same atoms approach each other to bond, the graph that best represents the changes of **Potential Energy** (E_p) **vs Nuclear Distance** (d), when only the repulsive forces between the atoms are considered, will be:



1.9 Which ONE of the following species contains a dative covalent bond?

A NH_3 **B** CH_4 **C** H_3O^+ **D** NF_3

1.10 Consider the Lewis structure of a compound below:



Which ONE of the following is CORRECT?

	Name of element X	Name of element Y	Molecular shape of compound
A	Chlorine	Oxygen	Angular
B	Oxygen	Chlorine	Linear
C	Chlorine	Sulphur	Linear
D	Sulphur	Chlorine	Angular

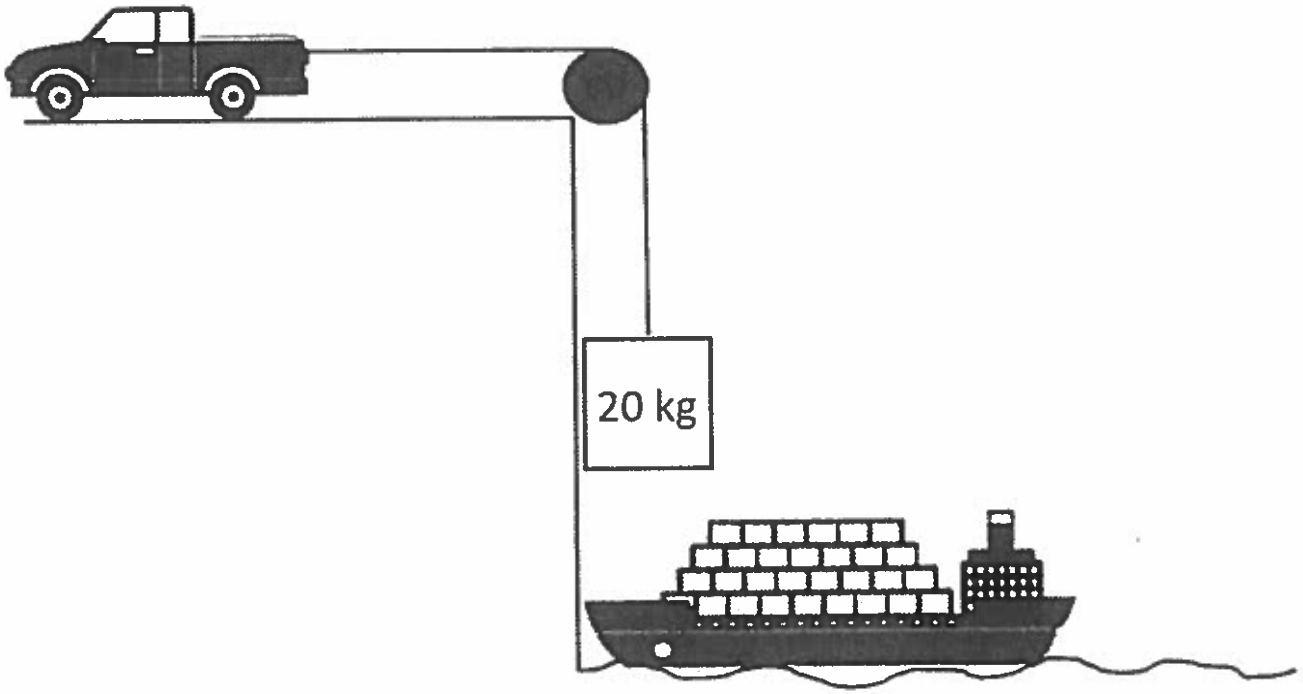
[20]

SECTION B

Answer on the folio paper –

QUESTION 2:

A 500 kg four-by-four bakkie is joined to a 20 kg crate by a light, inextensible rope as shown in the diagram below. The bakkie lifts the crate vertically up from a ship in the Port Elizabeth harbour. The bakkie's motor produces a force of 1 646 N to the left whilst the force of friction between the bakkie's tyres and the harbour surface is 150 N. Assume the pulley is frictionless and ignore the effects of air resistance.



2.1 State *Newton's third law of motion* in words. (2)

2.2 Draw a free-body diagram showing ALL the forces acting on the bakkie. (5)

2.3 Calculate:

2.3.1. The magnitude of the acceleration of the system. (5)

2.3.2. The magnitude of the tension in the rope. (2)

2.4 Port Elizabeth is often very windy. Therefore, the effects of air resistance cannot always be ignored. Assuming the applied force of the bakkie remains the same, how will the magnitude of the acceleration of the crates be affected on a day when the wind is blowing out to the sea (i.e. to the right)? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

[15]

QUESTION 3:

A space shuttle, attached to a rocket, is launched into the atmosphere as shown in figure 1. At a certain height, the space shuttle detaches from the rocket and begins to orbit the Earth at a distance of 6000 km from the SURFACE of the Earth as shown in figure 2.

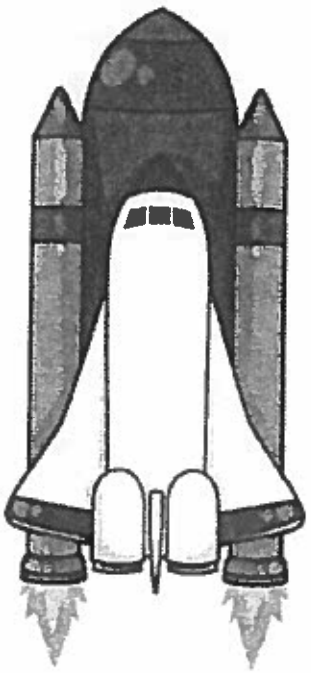


Figure 1

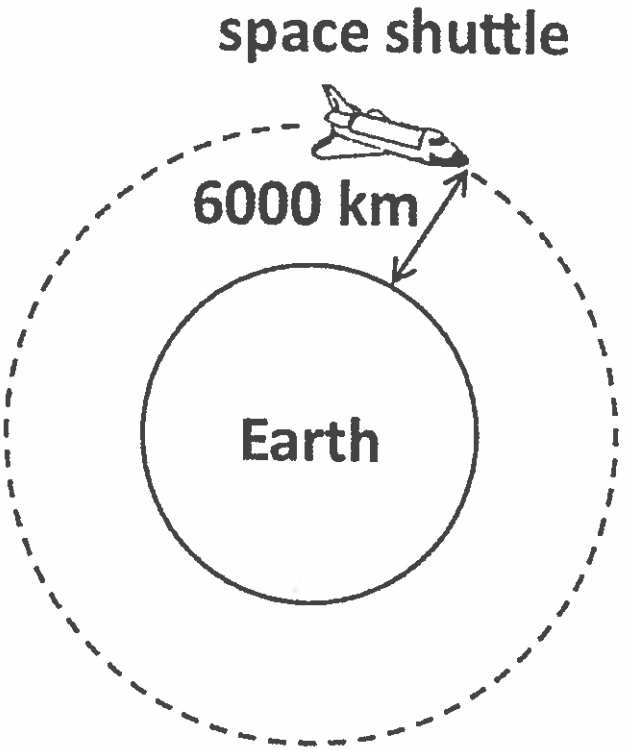


Figure 2

3.1 State *Newton's Universal Law of Gravitation* in words. (2)

3.2 Identify one action-reaction pair of forces in figure 1. (2)

3.3 If the space shuttle has a mass of 2000 kg, calculate the gravitational force exerted by the Earth on the space shuttle once it is in orbit. (4)

3.4 How does the force of the Earth on the space shuttle change as the space shuttle moves away from the Earth's surface into orbit? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

3.5 What is the magnitude of the force exerted by the space shuttle on the Earth when the space shuttle is in orbit? (1)

[10]

QUESTION 4:

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

4.2 Draw a Lewis diagram for hydrogen cyanide (HCN). (2)

4.3 How many bonds are there between the C and N atoms in HCN? (1)

4.4 Represent HCN using Couper notation. (1)

4.5 Give the shape of the central atom in:

4.5.1 PH_3 (1)

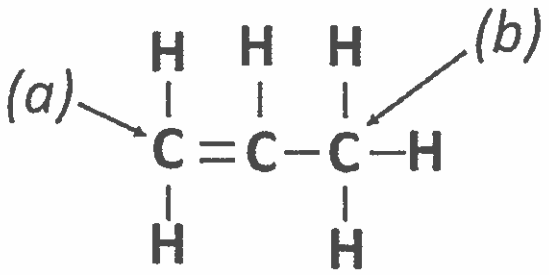
4.5.2 H_2O (1)

4.5.3 SF_6 (1)

4.5.4 $BeCl_2$ (1)

4.6 Use Lewis diagrams to show the formation of the ammonium molecule (NH_4^+) from ammonia (NH_3) and the hydrogen ion (H^+). (3)

4.7 The Couper notation for propene (C_3H_6), an organic molecule, is drawn below.



Write down the shape of the molecule if:

4.8.1 ...the carbon atom labelled (a) is taken to be the central atom. (1)

4.8.2 ...the carbon atom labelled (b) is taken to be the central atom. (1)

[15]