NATIONAL SENIOR CERTIFICATE

NAME OF SCHOOL: ……..

NAME OF CIRCUIT: ……..

PHYSICAL SCIENCES: CONTROLLED TEST 1
GRADE 12
20 MARCH 2015

Marks: **100**

Time: **2 Hours**

This question paper consists of 10 pages and 7 questions.

INSTRUCTIONS AND INFORMATION

1. Write your name, date and grade on the answer sheet and on the graph paper.
2. This question paper consists of FIVE questions. Answer all the questions in the answer sheet.
3. Start each question on a NEW page in the answer sheet.

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. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Use are advised to use the attached DATA SHEETS provided.
9. Show all formulae and substitutions in all calculations.
10. Round off your final numerical answers to a minimum of two decimal places.
11. Give brief motivations, discussions, etc were 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 sheet, for example. 1.1. A.

1.1. Which ONE of the following physical quantities is a measure of the inertia of a body?

A Mass
B Energy
C Velocity
D Acceleration (2)

1.2. An object is thrown vertically upwards. Which ONE of the following regarding the object's velocity and acceleration at the highest point of its motion is CORRECT? Ignore the effect of friction.

	VELOCITY	ACCELERATION
A	Zero	Zero
B	Zero	Upwards
C	Maximum	Zero
D	Zero	Downwards

(2)

1.3. If the momentum of an object is doubled, then its kinetic energy is .....

A. Halved
B. Doubled
C. Three times greater
D. Four times greater (2)

1.4. One of the following concepts CORRETLY describes the force that opposes the motion of a moving object relative to a surface.

A. Static frictional force
B. Kinetic frictional force
C. Normal force
D. Frictional force (2)

1.5. Which ONE of the compounds below is an aldehyde?

A CH_3CHO
B CH_3COCH_3
C CH_3COOH
D CH_3OH (2)

1.6. The reaction represented by the equation below takes place in the presence of a

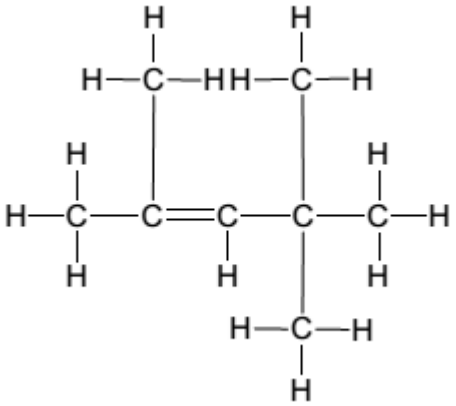
catalyst:

$$C_{13}H_{28}(\ell) \rightarrow C_2H_4(g) + C_3H_6(g) + C_8H_{18}(\ell)$$

This reaction is an example of…

A addition
B cracking
C substitution
D polymerisation (2)

1.7. Consider the structural formula of an organic compound below:



Which ONE of the following is the correct IUPAC name of this compound?

A 2,2,4-trimethylpent-2-ene
B 2,2,4-trimethylpent-3-ene
C 2,4,4-trimethylpent-2-ene
D 2,4,4-trimethylpent-3-ene (2)

[14]

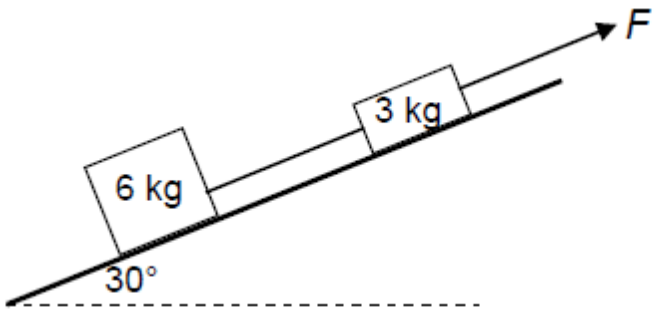
QUESTION 2 (Start on a new page)

An object with a mass of 6 kg lies on a horizontal surface.

2.1. Calculate its maximum static friction if $\mu_s = 0,4$. (5)

2.2. Define Static frictional force. (2)

A light inelastic string connects this object of mass 6 kg with an object of 3 kg. They are pulled up an inclined plane that makes an angle of 30° with the horizontal, with a force of magnitude *F*. Ignore the mass of the string.

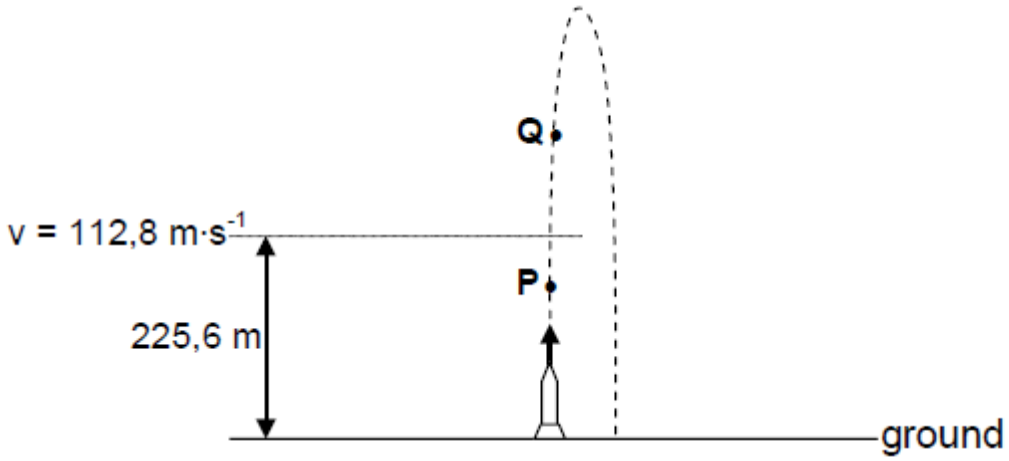


The coefficient of kinetic friction for the 3 kg object and the 6 kg object is 0, 1 and 0, 2 respectively.

2.3. State Newton's Second Law of Motion in words. (2)
2.4. How will the coefficient of kinetic friction be affected if the angle between the incline and the horizontal increases? Write down only INCREASES, DECREASES or REMAINS THE SAME. (1)
2.5. Draw a labeled free-body diagram indicating all the forces acting on the 6 kg object as it moves up the inclined plane. (4)
2.6. Calculate the:
2.6.1. Tension in the string if the system accelerates up the inclined plane at 4 $m \cdot s^{-2}$ (5)
2.6.2. Magnitude of *F* if the system moves up the inclined plane at CONSTANT VELOCITY (4)
[23]

QUESTION 3 (Start on a new page)

A stationary rocket on the ground is launched vertically upwards. After 4 s, the rocket's fuel is used up and it is 225,6 m above the ground. At this instant the velocity of the rocket is 112,8 $m \cdot s^{-1}$. The diagram below shows the path followed by the rocket. Ignore the effects of air friction. Assume that g does not change during the entire motion of the rocket.



3.1. Explain what is meant by a **projectile** (2)

3.2. Write down the direction of the acceleration of the rocket at point:

3.2.1. P (1)

3.2.2. Q (1)

3.3. At which point (**P** or **Q**) is the rocket in free fall? Give a reason for the answer. (2)

3.4. TAKING UPWARD MOTION AS POSITIVE, USE EQUATIONS OF MOTION to calculate the time taken from the moment the rocket is launched until it strikes the ground. (6)

3.5. Sketch a velocity versus time graph for the motion of the rocket from the moment it runs out of fuel until it strikes the ground. Take the time when the rocket runs out of fuel as t = 0 s.
Clearly indicate the following values on the graph:

• Velocity of the rocket when it runs out of fuel
• Time at which the rocket strikes the ground (4)
[15]

QUESTION 4 (Start on a new page)

4.1. A ball with a mass of 300g collides head-on with a wall at 12 $m.s^{-1}$ and bounces back with a velocity of 8 $m.s^{-1}$.

4.1.1. Calculate the change in momentum of the ball. (5)

4.1.2. Determine the impulse of the wall on the ball. (2)

4.1.3. Calculate the magnitude of the force that the wall exerts on the ball if the collision time is 0,01 s (4)

4.2. A blue ball of mass 0,6 kg travelling at 5 $m.s^{-1}$ on a frictionless surface, strikes a stationary yellow ball of mass 0,3 kg. After the collision, the blue ball continues to move in its original direction at 2 $m.s^{-1}$, while the yellow ball moves in front of the blue ball. Determine the velocity of the yellow ball. (6)

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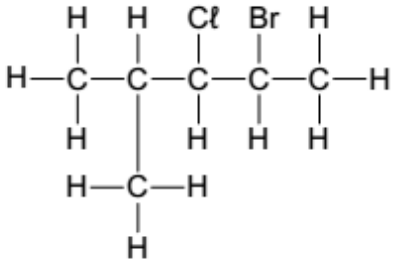
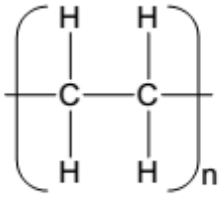
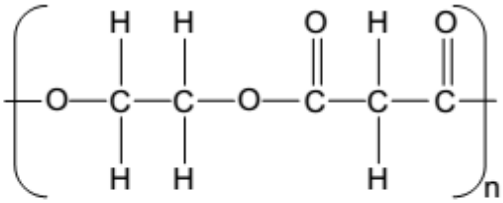
QUESTION 5 (Start on a new page.)

Consider the organic compounds represented by the letters **A** to **F** in the table below.

A	2,2,4-trimethylhexane	**B**	$CH_3CH_2CH_2CH_2CHO$
C		**D**	
E		**F**	Pentan-2-one

5.1. Write down the LETTER(s) that represents the following:

5.1.1. An aldehyde (1)

5.1.2. A condensation polymer (1)

5.1.3. Two compounds that are functional isomers (2)

5.2. Write down the IUPAC name of:

5.2.1. Compound **C** (2)

5.2.2. The monomer of Compound **D** (1)

5.3. Write down the structural formula of:

5.3.1. Compound **A** (2)

5.3.2 Compound **F** (2)

[11]

QUESTION 6 (Start on a new page.)

6.1. Learners investigate facttors that influence the boiling points of alkanes and alcohols. In one of the investigations they determine the boiling points of the first three alkanes.

6.1.1. Write down an investigative question for this investigation. (2)

6.1.2. Fully explain why the boiling point increases from methane to propane. (2)

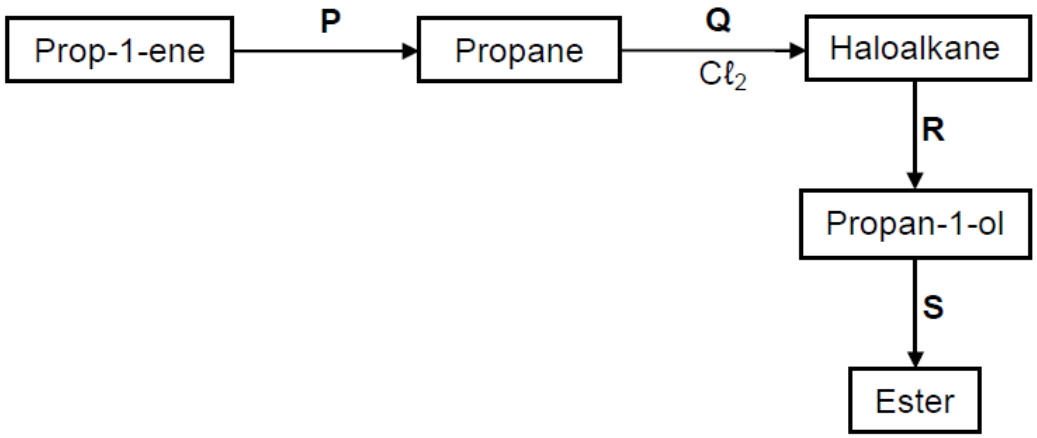
6.2. The learners find that the boiling point of propan-1-ol is higher than that of propane.

Explain this observation by referring to the TYPE of INTERMOLECULAR FORCES pesent in each of these compounds. (3)

[7]

QUESTION 7 (Start on a new page.)

The flow diagram below shows the preparation of an ester using prop-1-ene as a starting reagent. P, Q and S represent different organic reactions.



7.1. Write down the type of reaction represented by:

7.1.1. **Q** (1)

7.1.2. **R** (1)

7.2. For reaction **P** write down the:

7.2.1. Type of addition reaction (1)

7.2.2. Balanced equation using structural formulae (3)

7.3. In reaction **S** proapan-1-ol reacts with ethanoic acid to form the ester.

For this reaction write down the:

7.3.1. FORMULA or NAME of the catalyst needed. (1)

7.3.2. Structural formula of the ester formed (2)

7.4. The propan-1-ol formed in reaction R can be convereted to pro-1-ene. Write down the FORMULA or NAME of the inorganic reagent needed. (1)

7.5. Alkanes burn readily in oxygen. Write down a balanced equation, using

molecular formulae, for the combustion of propane in excess of oxygen.(3)

[13]

GRAND TOTAL: 100

INFORMATION SHEETS

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	$9,8\ m\cdot s^{-2}$
Universal gravitational constant	G	$6,67 \times 10^{-11}\ N\cdot m^2\cdot kg^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^{8}\ m\cdot s^{-1}$
Planck's constant	h	$6,63 \times 10^{-34}\ J\cdot s$
Coulomb's constant	k	$9,0 \times 10^{9}\ N\cdot m^2\cdot C^{-2}$
Charge on electron	e	$-1,6 \times 10^{-19}\ C$
Electron mass	m_e	$9,11 \times 10^{-31}\ kg$

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{net} = ma$	$p = mv$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$g = \frac{Gm}{r^2}$