GRADE 12

PHYSICAL SCIENCES:
CONTROLLED TEST
MARCH 2016

MARKS: 100

NAME OF SCHOOL……

This paper consists of 12 pages including this cover page

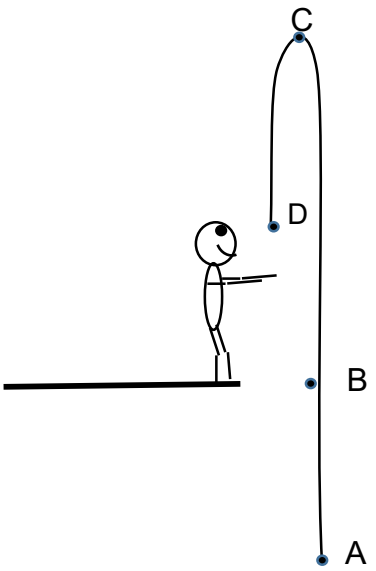
INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions in the answer book.
2. Non-programmable calculations may be used.
3. Appropriate mathematical instrument may be used.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Data sheets are attached for your use.
6. Give brief motivation, discussions, et cetera where required.

QUESTION 1 (Start on a new page.)

Four options are provided as possible answers to the following questions.
Each question has ONE correct answer. Write only the letter (A-D) next to the question number.1.1.D.

1.1. A person dives from a high platform into a pool. At which ONE of the positions A, B, C or D will the magnitude of his momentum be at its maximum?



(2)

1.2. An object projected vertically upwards reaches its maximum height and returns to its original point of projection. Ignoring the effects of friction, the direction of the acceleration of the object during its motion is…….

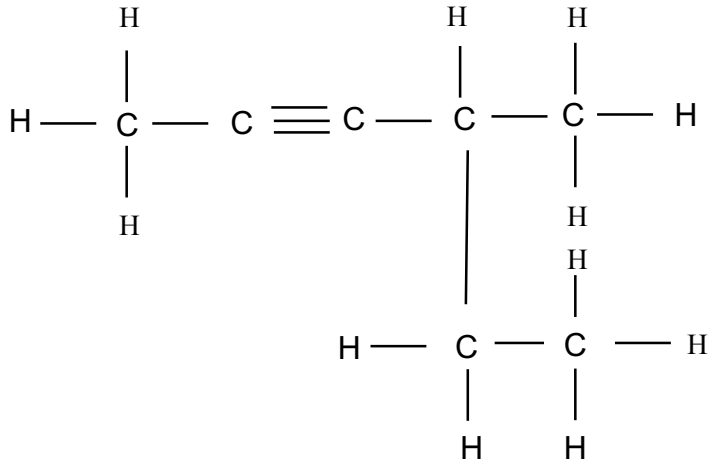
A. Always vertically downwards.
B. First vertically upwards and then vertically downwards.
C. First vertically downwards and then vertically upwards.
D. Always vertically upwards. (2)

1.3. Which ONE of the following compounds has dipole-dipole forces between its molecules?

A. Ethane
B. Ethene
C. Ethanol

D. Ethyne. (2)

1.4. The structural formula of an organic is shown below. Which ONE of the following is the correct IUPAC name of the above compound?



A. 2-ethylpent-3-yne.
B. 4-ethylpent-3-yne
C. 4-methylhex-2-yne.
D. 3-methylhex-3-yne. (2)

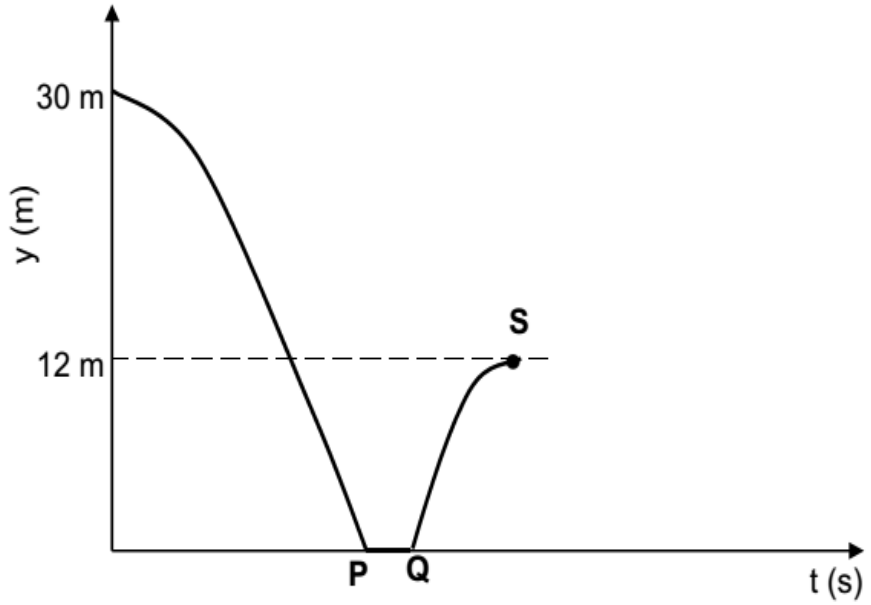
1.5. Which ONE of the following pairs of reactants can be used to prepare the ester ethyl methanoate.

A. Ethane and methanoic acid.
B. Methanol and ethanoic acid.
C. Ethanol and methanoic acid.
D. Ethene and methanol. (2)

[10]

QUESTION 2 (Start on a new page.)

The position-time graph for a ball, thrown down from a height 30 m above a concrete floor, is shown in the diagram below. Ignore the effects of air friction.



The ball first hits the floor at **P** with a speed of 25 $m.s^{-1}$. The ball is in contact with the floor for a period of 0'8 s(i.e., **PQ** is 0,8 s) and then rises to point **S**.

2.1. What do you understand by the term *free fall?* (2)

2.2. Write down the height reached by the ball after it bounces off the floor. (1)

2.3. Calculate the:

2.3.1. Initial speed of the ball. (4)

2.3.2. Time taken to reach point **P.** (4)

2.3.3. Total time taken by the ball to reach point **S after it was thrown.** (6)

2.4. Draw a velocity versus time graph for the motion of the ball from the instant it is thrown to the time it first hits the floor. Show the following on your graph:

The initial velocity
Velocity at **P**
Time at **P** **(4)**

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QUESTION 3 (Start on a new page.)

In the picture below, a cricket ball, of mass 150 g, approaches a bat at 40 $m.s^{-1}$ FROM THE LEFT. It is RETURNED (hit back directly, along the same straight line, in the opposite direction) at 25 $m.s^{-1}$. Ignore the effects of air friction.

Assume that the ball is in contact with the bat for 0,4 s and TAKE MOTION FROM LEFT AS NEGATIVE.

3.1. State the principle of conservation of momentum in WORDS. (2)

3.2. Calculate the:

3.2.1 Magnitude of the initial momentum of the ball. (3)

3.2.2 Magnitude of the final momentum of the ball. (3)

3.2.3 Magnitude of the net force exerted by the bat on the ball. (3)

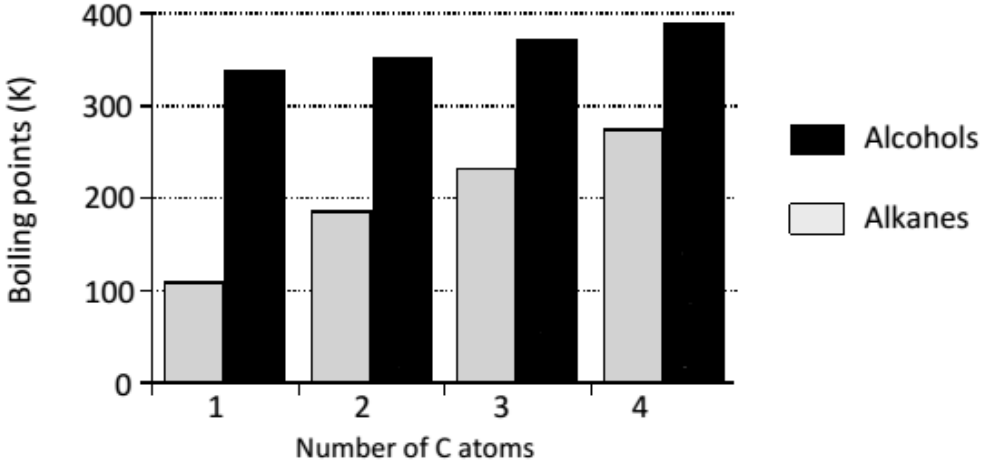
3.3. Describe how the magnitude of the net force, calculated in QUESTION 3.2.3, will change if the contact time was reduced to 0,2 s (2)

3.4. During the collision of the bat with the ball, a sound is heard. Use this fact and any other information to explain why the collision between the bat and the ball is inelastic. (2)

[15]

QUESTION 4 (Start on a new page)

The bar graphs below show the boiling points of the first four alkanes and the boiling points of the first four primary alcohols.



4.1. How do the boiling points of the four alcohols compare to that of the corresponding alkanes? Only write down HIGHER THAN, LOWER THAN or EQUAL TO. (1)

4.2. Fully explain the answer to QUESTION 4.1. In your explanation refer to the TYPE of intermolecular forces that are present in alkanes and alcohols, as well as the energy involved. (3)

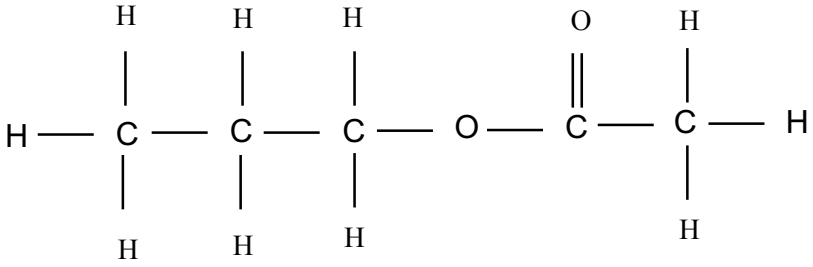
4.3. Write down the IUPAC name of the alcohol represented in the above graph, with the lowest vapour pressure. (1)

4.4. Fully explain why the alcohol mentioned in QUESTION 4.3 has the lowest boiling point. In your explanation refer to molecular structure, intermolecular forces and energy involved. (3)

[8]

QUESTION 5 (Start on a new page.)

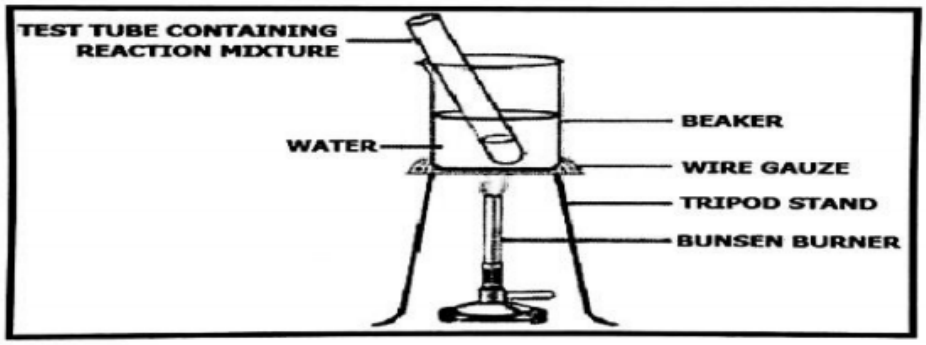
Esters are often used as compounds of synthetic fragrances. They are synthesized by the reaction of carboxylic acid and alcohol. The following ester has a fragrance of pear and is used in food industry.



5.1. Give the IUPAC name of the above ester. (1)

5.2. To prepare the above ester in a laboratory, the two organic reactants are mixed together in the test tube. A few drops of a certain concentrated acid are added

and the test tube is placed in water bath and then heated as illustrated below.



5.2.1. Name the acid of which few drops are added onto the mixture. (1)

5.2.2. Give the IUPAC name of the carboxylic acid which forms the above ester. (1)

5.2.3. Give the IUPAC name of the alcohol used in this experiment. (1)

5.2.4. Why must the test-tube be heated in a hot water bath and not directly over the flame? (1)

5.2.5. The concentrated acid used in this reaction is considered as a catalyst in this reaction. What property of the acid makes it suitable to be used as a catalyst for the preparation of ester? (1)

5.2.6. Write down the name of the non-organic molecule that is formed as a by-product during this reaction. (1)

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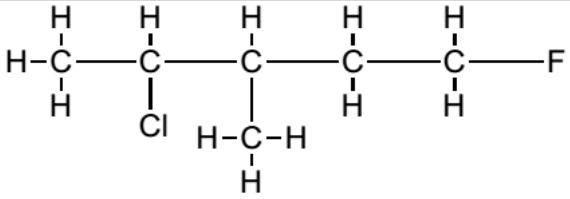
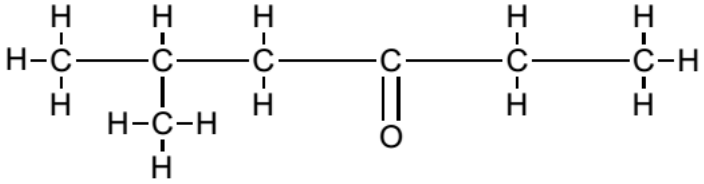
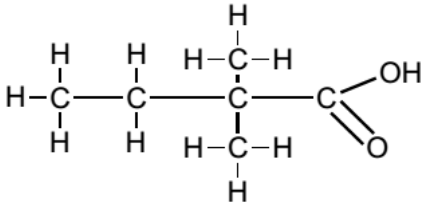
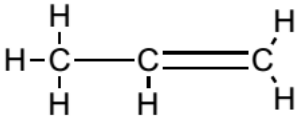
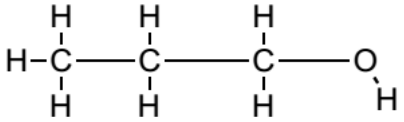
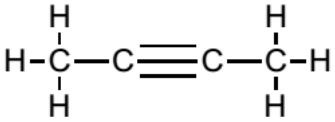
QUESTION 6 (Start on a new page)

The letters **A** to **I** in the table below represent six organic compounds.

A		**B**	$CH_3CH_2CH_2C\ell$
C		**D**	methylbutanoate
E		**F**	
G		**H**	
I	C_4H_{10}		

6.1. Write down the:

6.1.1. Structural formula for the functional group of compound **E.** (2)

6.1.2. IUPAC name of compound **A**. (2)

6.1.3. IUPAC name of compound **F**. (1)

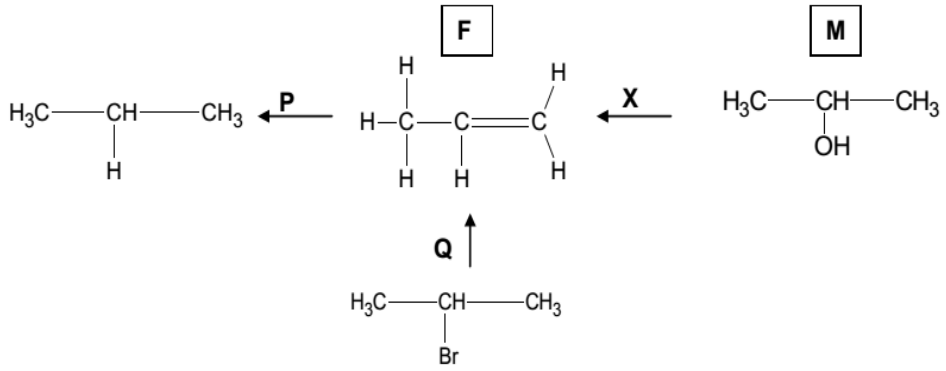
6.1.4. General formula for the homologous series to which compound **H** belongs. (2)

6.1.5. Names of the organic compounds that react to form compound **D.** (2)

6.1.6. Name of the homologous series to which compound **B** belong. (2)

6.1.7. What type of organic compound is represented by **G**? (2)

6.2. Some organic reactions, involving compounds **F** and **M**, are shown below.

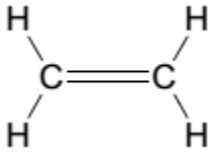


6.2.1. Write down the NAME of the reaction, **X**, that converts compound **M** to compound **F** and write down a chemical formula for the catalyst used in the reaction. (2)

6.2.2. Write down the NAME of the reaction **Q** and also write down the NAME of the conditions under which the reaction **Q** occurs. (2)

6.2.3. Write down the NAME of reaction **P**. (2)

6.3. The compound shown below is a monomer in a polymerisation reaction.



6.3.1. What is a monomer? (2)

6.3.2. What is polymerisation? (2)

6.3.3. Write down an equation for the polymerisation of this monomer and NAME the polymer formed. (5)

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QUESTION 7 (Start on a new page)

The table shows the data collected for three organic compounds A, B and C with different functional groups during investigation.

	COMPOUND	MELTING POINT
A	CH_3-CH_3	-183,3
B	CH_3-CH_2OH	-114
C	CH_3-COOH	16.6

7.1. In the above investigations name the following:

7.1.1. The independent variable. (1)

7.1.2. The controlled variable. (1)

7.2. Describe the trend in the melting points as shown in the table. (2)

7.3. Explain the trend in (7.2) by referring to intermolecular forces and energy. (3)

7.4. You are given two test tubes containing alkane and alkenes respectively. Your teacher requires you to identify those compounds.

7.4.1. Name the substance you will need to carry out the above investigation. (1)

7.4.2. Briefly describe the procedure you will follow to reach your conclusion. (3)

. **[11]**

TOTAL MARKS: 100

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	$9,11 \times 10^{-31}\ kg$

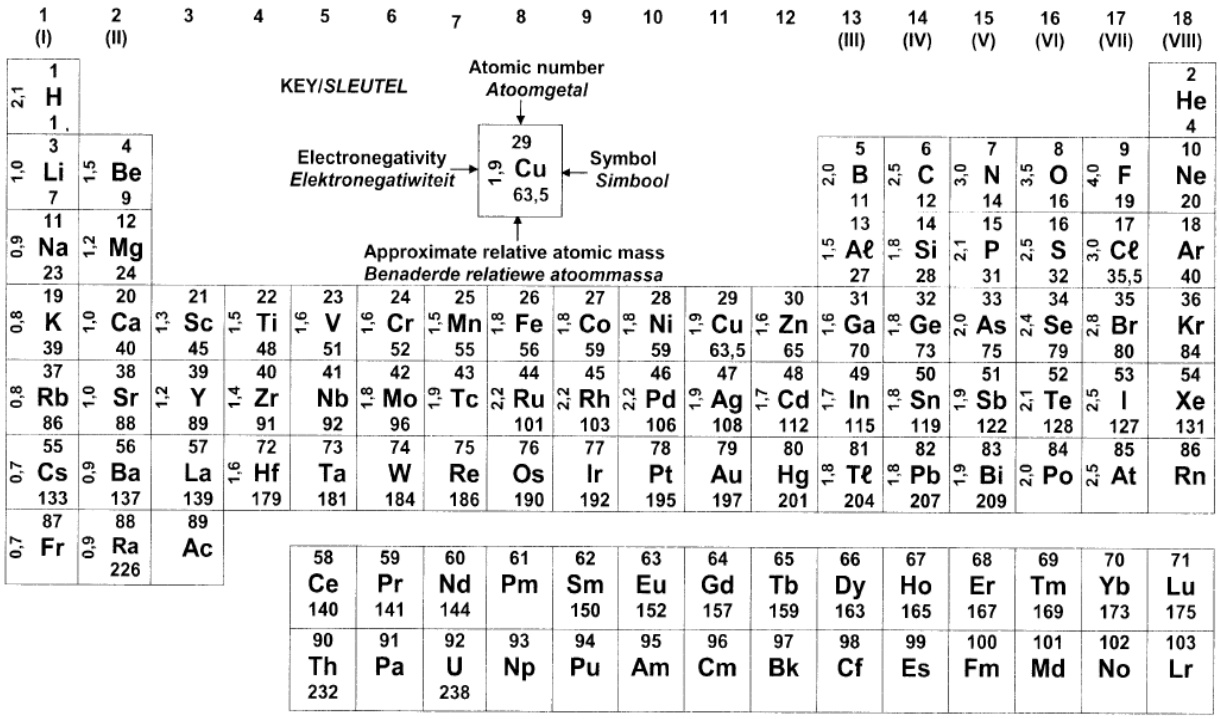
TABLE 2: FORMULAE

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

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



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	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	La 139	1,6 Hf 179	Ta 181	W 184	Re 186	Os 190	Ir 192	Pt 195	Au 197	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	0,9 Ra 226	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 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