HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE
GRADE 12
PAPER 1- Physics

JUNE 2014
TIME: 2 HRS

Total 100

Instructions

1. Answer ALL the questions.
2. This question paper consists of TWO sections:
3. SECTION A (16)
   SECTION B (84)

   Answer SECTIONS A and B in the ANSWER BOOK.
4. Non-programmable calculators may be used.
5. Appropriate mathematical instruments may be used.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Data sheets and a periodic table are attached for your use.
8. Give brief motivations, discussions, et cetera where required.
9. Numbers must be rounded off to **two decimal** places

SECTION A

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 – 1.8) in the ANSWER BOOK.

1.1 A boat travels east at 13 $km.h^{-1}$ when a tide is flowing north at 1.2 $m.s^{-1}$. The actual speed of the boat would be:

A. 12,94 $m.s^{-1}$

B. 13,10 $m.s^{-1}$

C. 3,40 $m.s^{-1}$

D. 3,80 $m.s^{-1}$

1.2 A net force *F* acts on a body with a mass *m* to produce an acceleration *a*. What will the acceleration be if the force is doubled and mass is halved?

A. $2a$

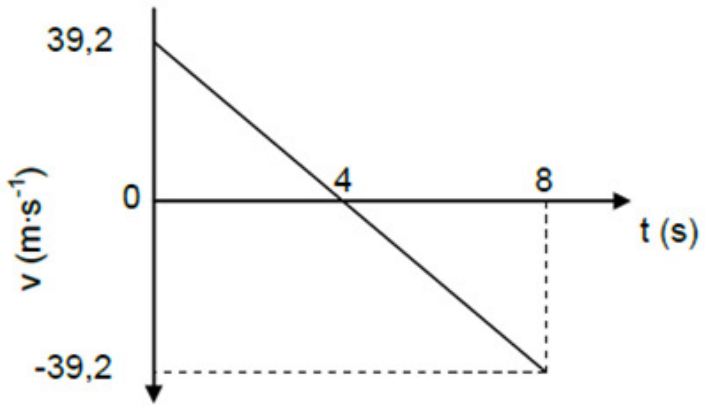
B. $\frac{1}{2}a$

C. $1a$

D. $4a$

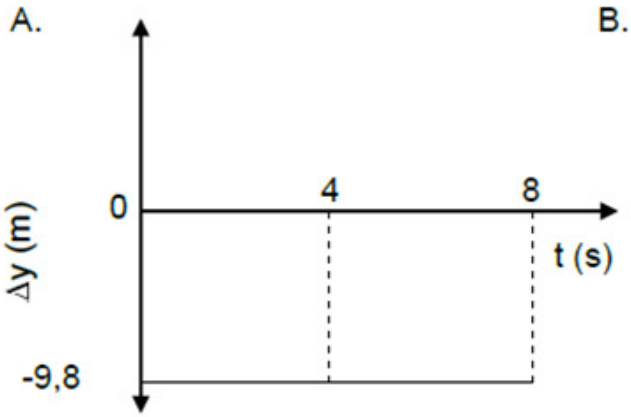
1.3

Mali hits the cricket ball from the ground straight up in the air. The following graph of velocity vs. time was drawn. Upwards is taken as positive. Study the graph and answer the question that follows:

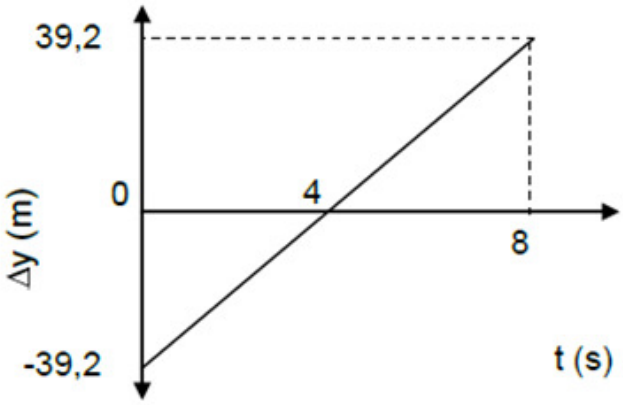


Which of the following graphs represents the corresponding position vs. time graph **for** the graph above?

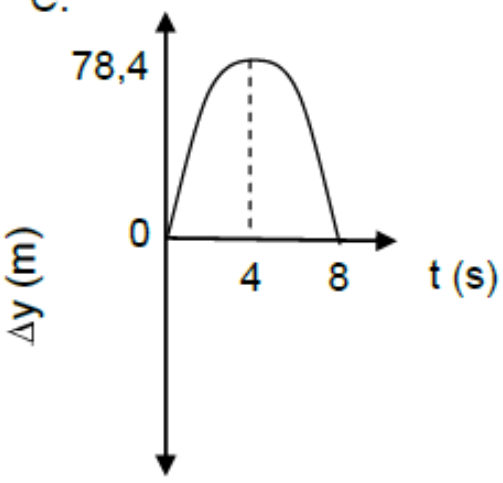
A.



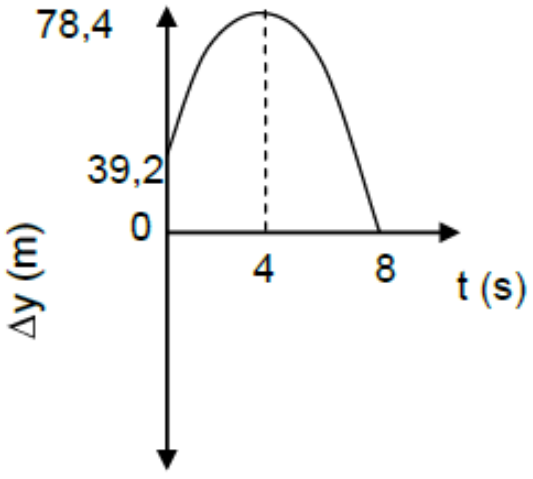
B.



C.



D.

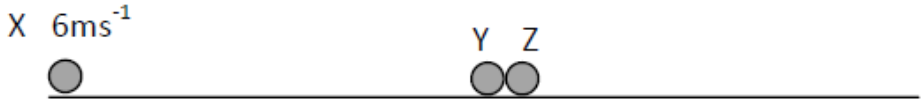


1.4 The quantity which REMAINS CONSTANT for an object falling to the ground is ... (Ignore air friction).

A potential energy.
B kinetic energy.
C mechanical energy.
D momentum.

1.5

Snooker ball X initially moves with a horizontal velocity of $6ms^{-1}$ to the right and collides with two identical snooker balls Y and Z which are stationary.



If both momentum and kinetic energy are conserved in the collision, indicate which answer correctly gives the horizontal velocity in ms^{-1} for the three snooker balls after the collision:

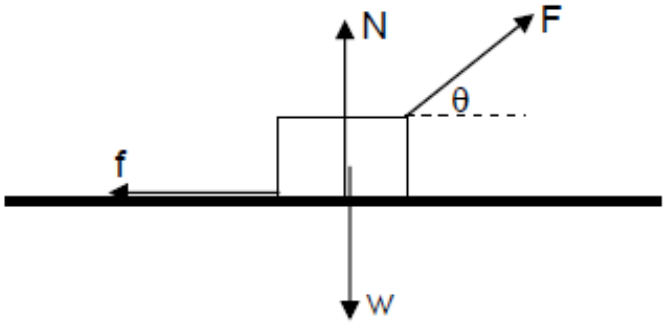
	X	Y	Z
A	0	0	0
B	0	2	− 4
C	2	− 2	2
D	0	0	6

1.6 The kinetic energy of an object X is E. An object Y has double the mass and moves with twice the velocity of X. The kinetic energy of Y is …

A. 2E.
B. 4E.
C. 6E.
D. 8E.

1.7

An object is pulled along a straight horizontal road to the right without being lifted. The force diagram below shows all the forces acting on the object.



Which ONE of the above forces does POSITIVE WORK on the object?

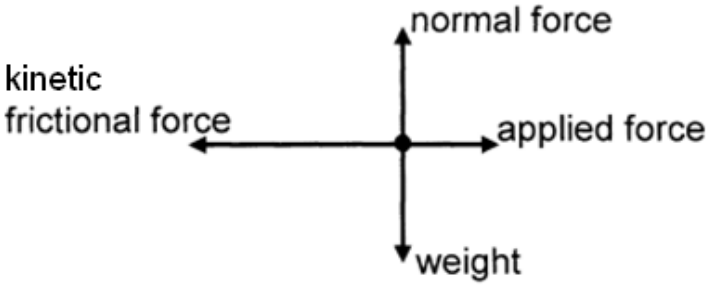
A w

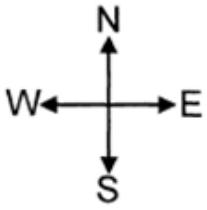
B N

C f

D F

1.8 The free-body diagram below shows the relative magnitudes and directions of all the forces acting on an object moving horizontally in an easterly direction.





The kinetic energy of the object ...

A is zero.

B increases.

C decreases.

D remains constant.

[2 x 8 = 16]

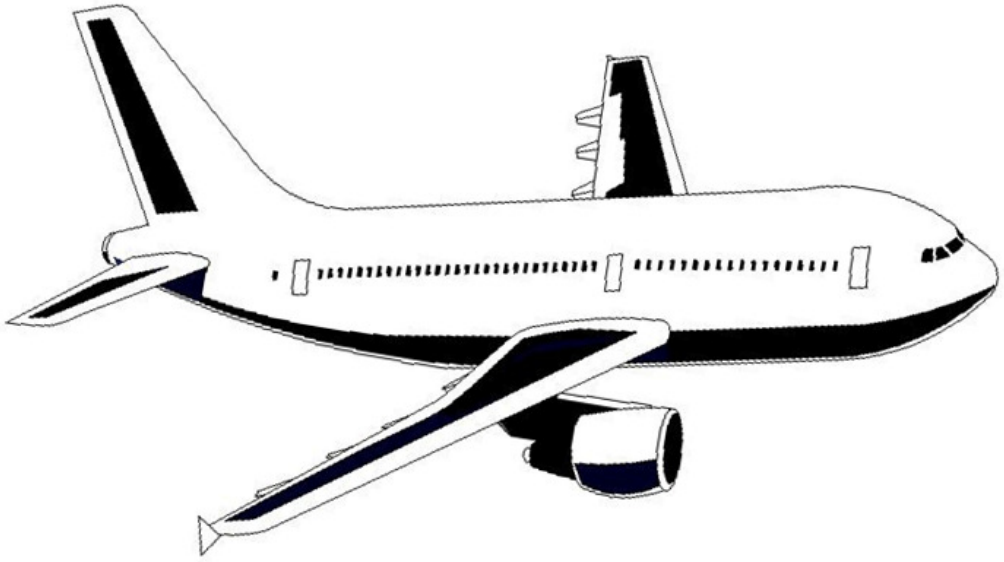
SECTION B

INSTRUCTIONS AND INFORMATION

1. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
2. Show the formulae and substitutions in ALL calculations.
3. Round off your numerical answers to **TWO decimal** places

Question 2

An airplane is pointing straight east and flying with airspeed of 300 $km.h^{-1}$.There is a southerly wind of 80 $km.h^{-1}$. What is the actual **direction** of the flight of the plane and what is its **ground speed**? (Draw a vector triangle to help solve the problem.)

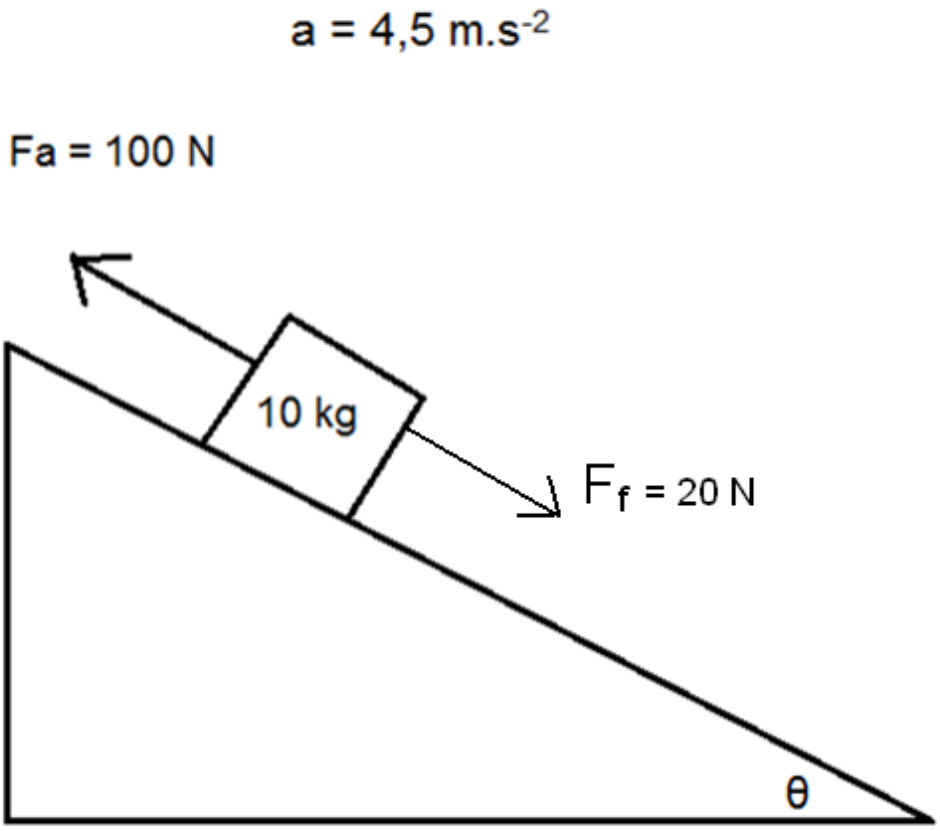


[7]

Question 3

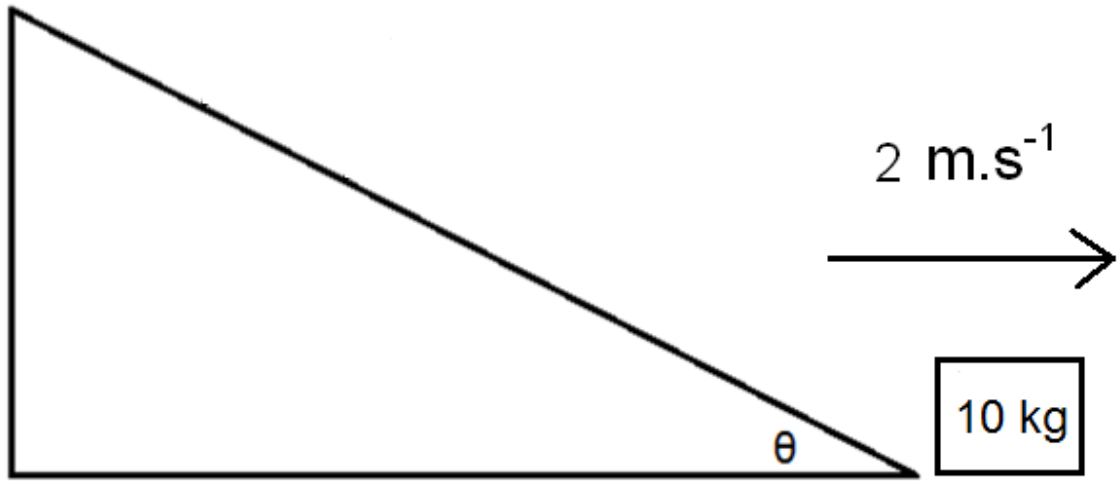
3.1 A 10 kg box is pulled with a force of 100 N up a rough inclined plane. The box accelerates at 4,5 $m.s^{-2}$ up the slope. A frictional force of 20 N acts on the box as it is being pulled up the slope.

3.1.1 Determine the angle of the slope.



[5]

3.1.2 Eventually the block is released and slides down the slope onto the floor. The block reaches the floor with a speed of $2 m.s^{-1}$ and slides horizontally for 4 m before it comes to rest. Calculate the coefficient of kinetic friction on the floor.

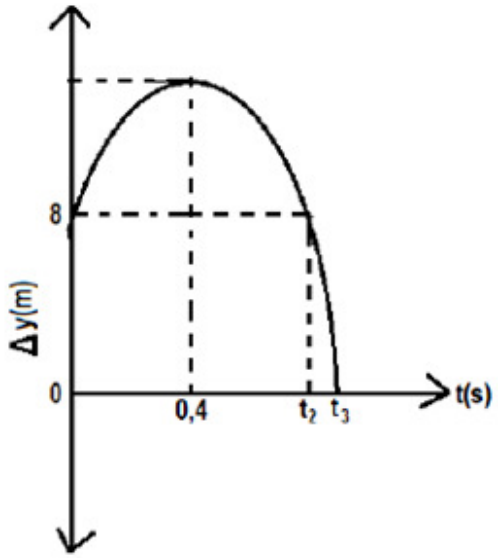


(7)

[12]

Question 4

The graph below is not drawn to scale and it shows the motion of a baseball that is thrown vertically upwards from a balcony which is some distance from the ground. It takes 0,4 s to reach the highest point, before it falls back to the ground. Study the graph and answer the questions that follow.
(Ignore the effects of air resistance.)



4.1 How high is the balcony above the ground? (1)

4.2 Determine the magnitude of the time t_2 without using the equations of motion. Motivate your answer. (2)

4.3 Calculate the initial velocity of the ball. (3)

4.4 Calculate the maximum height that the ball reaches above the ground. (4)

4.5 Calculate the final velocity of the ball when it reaches the ground. (4)

4.6 Calculate the time, t_3, that the ball was in the air. (3)

4.7 Draw a corresponding acceleration versus time for the motion of the baseball. (2)

4.8 The ball then bounces after it hits the ground and reaches a maximum height of 2m.

4.8.1 Calculate the initial velocity with which the ball bounces off the floor. (4)

4.8.2 Draw the velocity time graph for the entire motion of the object (Indicate all relevant intercepts on the axis.) **(6)**

[29]

QUESTION 5

Dale Steyn bowls a cricket ball, mass 156 g, towards Jacques Kallis. The ball reaches Jacques at a velocity of 41 $m.s^{-1}$ and he hits it straight past Dale at a velocity of 25 $m.s^{-1}$ for a boundary.

5.1 Calculate the momentum of the ball just before Jacques hits it. (3)

5.2 Determine the impulse of the ball on the bat. (4)

5.3 If the ball is in contact with the bat for 0,003 s, determine the magnitude of the force that the ball exerts on the bat. (3)

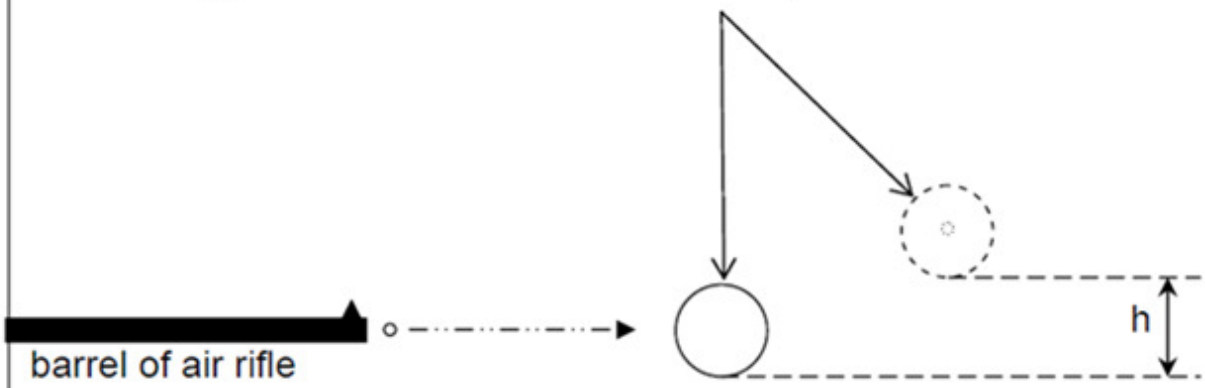
5.4 The captain advises the bowler to bowl a slow delivery. Use your knowledge of momentum and impulse to explain why the slow delivery is an effective alternative. (2)

[12]

Question 6

A ballistic experiment was carried out in an open field alongside a high brick wall for safety reasons.

A physical science student decides to investigate how the impact speed of a pellet fired from an air rifle is affected by the distance from the target. The student decides to fire the pellet gun at an apple which is suspended from a light string. The pellet gets stuck in the apple when it is fired. The apple and the pellet swing away to the right, as shown in the diagram, to a certain height h.
The mass of the pellet is 1,0 g and the mass of the apple is 100 g. The experiment is repeated by increasing the range by 5 m each time until the range is 20 m. (Ignore the effects of air resistance.)



6.1 Give a suitable hypothesis for this experiment. (1)

6.2 Identify for this experiment the following variables:

6.2.1 The independent variable (1)

6.2.2 The dependent variable (1)

6.3 Briefly explain how the student can measure the height to which the apple swings, using a protractor and trigonometry or any other suitable method. (3)

6.4 State the principle of conservation of mechanical energy in words. (2)

6.5 When the student fired at the apple, the height gained was 150 mm. Calculate the magnitude of the velocity of pellet plus apple immediately after impact. (4)

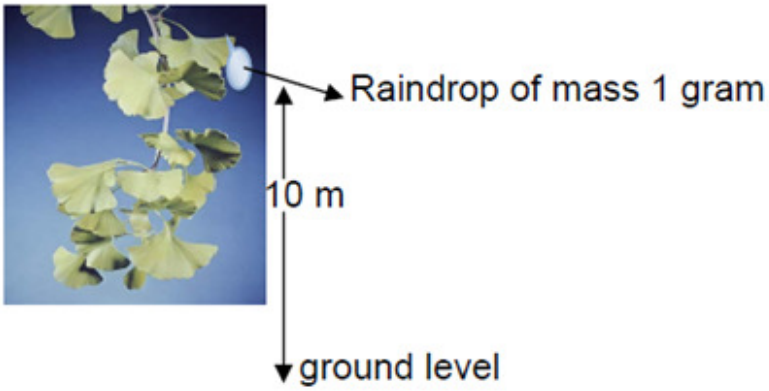
6.6 Calculate the magnitude of the velocity of the pellet just before impact. (3)

[15]

Question 7

7.1 State in words the work-energy theorem. (2)

7.2



A rain drop is initially at rest on a leaf and then falls under the influence of the downward gravitational force and the opposing frictional force (reaction force). Consider a drop of mass 1,00 g falling from the leaf at a height of 10 m above the ground and striking the ground with a speed of 4 ms^{-1}. Calculate the work done by the frictional force. (7)

[9]

Total 100