



HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE

GRADE 11

PAPER 1 - Physics



NOVEMBER 2015

TIME: 3 HRS

Total 152

Instructions

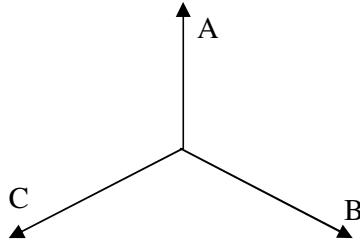
1. Answer ALL the questions.
2. This question paper consists of TWO sections:
3. SECTION A (20)
SECTION B (131)
Answer SECTIONS A and B in the ANSWER BOOK.
4. Non-programmable calculators may be used.
5. Appropriate mathematical instruments may be used.
6. Number the answers correctly according to the 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 – 1.10) in the ANSWER BOOK.

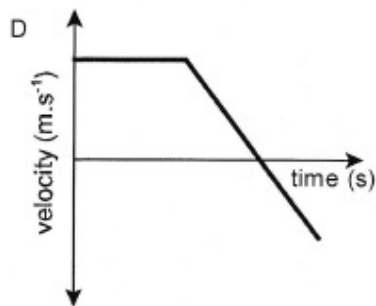
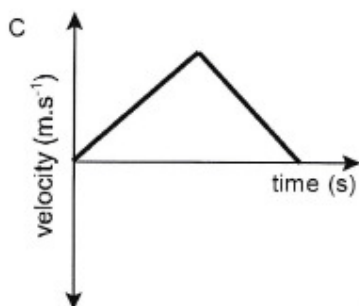
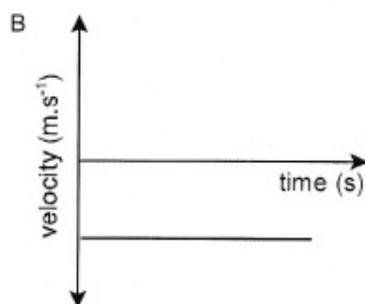
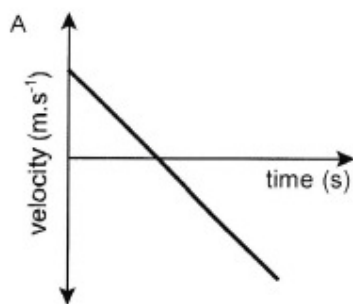
- 1.1. The vector diagram below shows three forces each of magnitude 5 N in equilibrium.



The angle between forces A and B is...

- A 60°
B 180°
C 120°
D 100°
- 1.2 Two forces of magnitudes 8N and 6N act at a point. Their angles can be changed. Which one of the following **cannot** be a resultant of these two forces?
A 2N
B 16N
C 10 N
D 14N
- 1.3 A girl of mass 50kg stands on a scale in a lift. While the lift is moving, the reading on the scale at a particular instant is 400N.
Which one of the following correctly describes the motion of the lift at this instant?
The lift is ...
A accelerating upwards.
B accelerating downwards.
C moving upwards at constant velocity.
D moving downwards at constant velocity.

1.4 A ball is thrown vertically upwards and then falls back below its original position. Which **ONE** of the following velocity-time graphs best represents the motion of the ball?



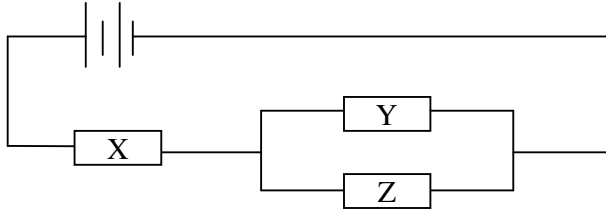
1.5 The acceleration due to gravity on the moon is one sixth that on earth. If there is a comparison of the mass and weight of an object on the moon and on earth, then on the moon its...

- A mass and weight are both less.
- B mass is less, but its weight is the same.
- C mass is the same, but its weight is less.
- D mass and its weight are the same on earth.

1.6 Two identical resistors are connected in parallel in a closed circuit. Which **ONE** of the following statements is **incorrect**?

- A The effective resistance of the parallel combination is smaller than the resistance of a single resistor.
- B The potential difference across each resistor is the same.
- C The current is divided equally between the two resistors.
- D No work is done across the two resistors.

- 1.7 Three identical resistors X, Y and Z are connected as shown in the circuit below.



If the power in X is P, then the power in Y is ...

- A $\frac{1}{4} P$
 - B $\frac{1}{2} P$
 - C P
 - D 2P
- 1.8 A light bulb is rated 240V (100W). Light is emitted when the filament of the bulb gets white hot. The number of joules of energy transformed by the bulb in every minute is:-

- A 2,4
- B 0,42
- C 24 000
- D 6 000

- 1.9 The centres of two identical metallic spheres, each carrying a charge Q, are a distance r apart. Which of the following pairs of changes, (that are made simultaneously), will double the electrostatic force that one charged sphere will exert on the other?

	Distance between the centres of spheres	Magnitude of charges
A	Decrease to distance to $\frac{r}{2}$	Double the charges on both spheres
B	Decrease to distance to $\frac{r}{2}$	Reduce the charge on one sphere to $\frac{Q}{2}$
C	Decrease distance to $\frac{r}{\sqrt{2}}$	Reduce the charge on both spheres to $\frac{Q}{2}$
D	Decrease distance to $\frac{r}{\sqrt{2}}$	Double the charge on both spheres

- 1.10. 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?

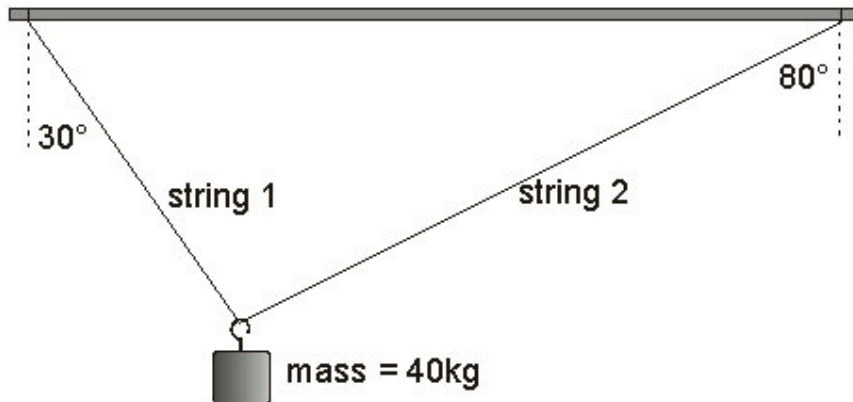
- A. $2a$
- B. $\frac{1}{2} a$
- C. $1a$
- D. $4a$

2 x 10= 20 marks

Section B

QUESTION 2

2.1. Two strings are attached to a large mass piece of 40kg and hold it in place as shown below.



2.1.1. Draw a fully labelled **force triangle** for the above image; show all forces acting on the mass piece. (also indicate all relevant angles) (4)

2.1.2. Looking at the force triangle you have drawn above, what can you deduce about all the forces acting on the mass piece? (1)

2.1.3. Calculate the magnitude of the tension in each string holding the mass. (5)

2.2. **Name** and **state** the law in Physics that can be used to explain each of the following situations:

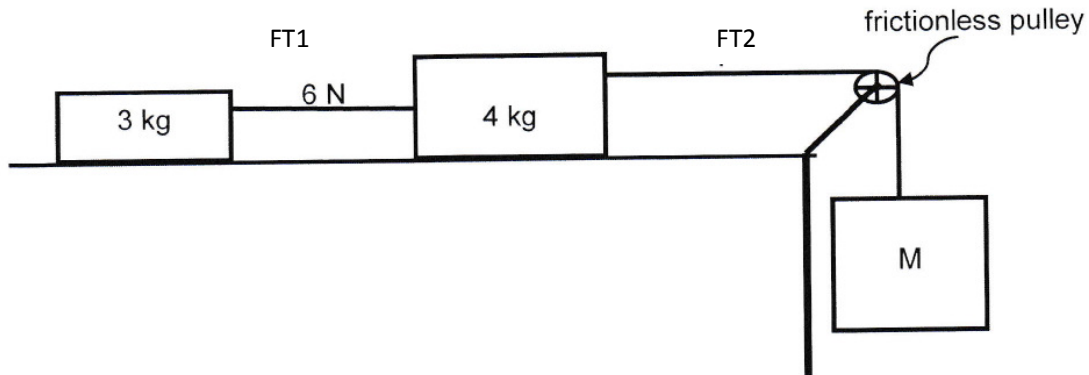
2.2.1. A passenger is flung forward when a car suddenly stops. (3)

2.2.2. When a person wearing roller skates pushes against a wall, he moves away from the wall. (3)

[16]

Question 3

Three blocks each of mass 3 kg, 4 kg and M kg respectively, are connected by a string. The surface and the pulley are both frictionless. The tension in the string between the 4 kg and 3 kg block is 6 N as shown in the diagram below. Ignore the effects of air friction.

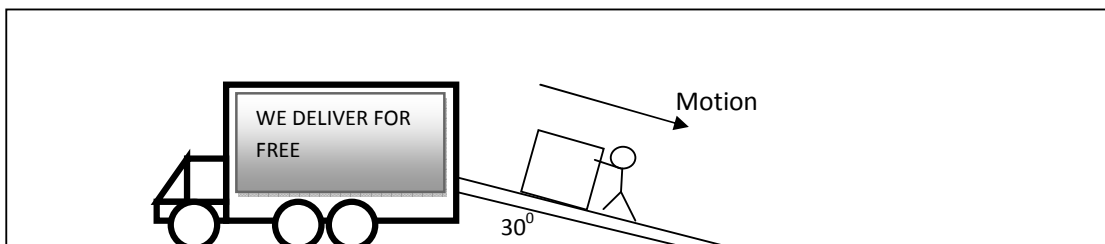


- 3.1. State Newton's Second law in words (2)
- 3.2. Draw a labeled freebody diagram showing ALL the forces acting on a **4kg block** (4)
- 3.3. Calculate the:
 - 3.3.1. Acceleration of a 3kg block (3)
 - 3.3.2. The Mass M (6)

[15]

Question 4

A delivery truck delivers a 200 kg load, to make the delivery of the heavy load easier the modern trucks have a long tray that allows the load to slide through. The tray makes an angle of 30 degrees with the horizontal. Tom the truck driver is exerting a force perpendicular to the load up the incline to control the off loading process. If the coefficient of dynamic (kinetic) friction between the tray and the load is 0.4 and the acceleration is $0,9 \text{ m}\cdot\text{s}^{-2}$; Calculate the force exerted by Tom.



[8]

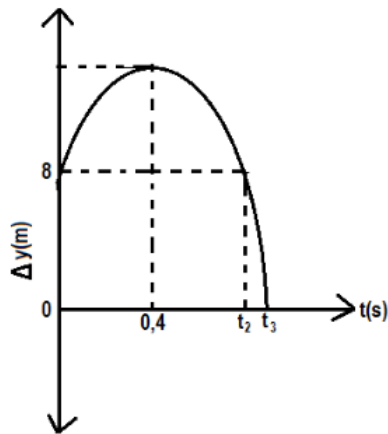
QUESTION 5

A comet with a mass of 3×10^3 kg was 200 km from earth at the point of its closest approach.

- 5.1 Name the force through which the comet and earth interact. (1)
- 5.2 Is the magnitude of the force experienced by the comet the same, greater than or less than the force experienced by the earth? Explain the answer. (2)
- 5.3 If the mass of the earth is $5,98 \times 10^{24}$ kg, calculate the force of attraction between earth and the comet at the point of its closest approach. (4)
- 5.4 State what happens to the acceleration of the comet as it approaches Earth. (Write only INCREASES or DECREASES or REMAINS THE SAME). Explain the answer. (3)
- 5.5 Two objects exert an attraction force of F on each other. By what factor will that force change if one mass is tripled and the distance between them is doubled? (2)
- [12]**

Question 6

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.



- 6.1. How high is the balcony above the ground? (1)
- 6.2. Determine the magnitude of time t_2 without using equations of motion. Motivate your answer (2)
- 6.3. Calculate the maximum height that the ball reached above the ground. (6)
- 6.4. The final velocity of the ball when it reaches the ground. (4)

6.5. The time, t_3 that the ball was in the air. (3)

6.6. Draw the corresponding velocity time graph. In your graph show:

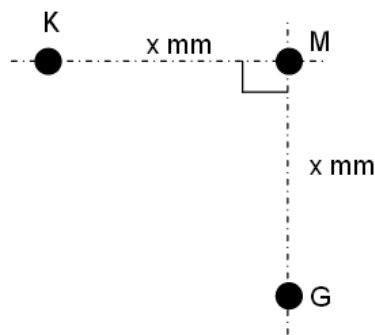
- The coordinate where the ball was thrown.
- The coordinate for the maximum height.
- The coordinate when the ball reaches the ground.

(5)

[21]

Question 7

Three small, identical metal spheres, K, M and G are placed in a vacuum. Each sphere carries a charge of 6 nC . The spheres are arranged such that K and G are each $x \text{ mm}$ from M as shown in the diagram below:



7.1. State Coulomb's law in words. (2)

The magnitude of the net force exerted on M by K and G is $2,864 \times 10^{-6} \text{ N}$

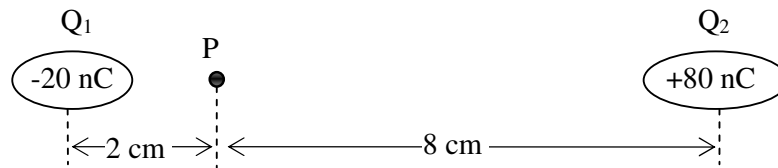
7.2. Calculate the magnitude of electrostatic force exerted by G on M. (4)

7.3. Calculate the distance x between G and M. (4)

[10]

QUESTION 8

Two point charges, Q_1 and Q_2 , are separated by a distance of 10 cm . Charge Q_1 has a magnitude of -20 nC and Q_2 magnitude $+80 \text{ nC}$. Point P is 2 cm to the right of charge Q_1 .



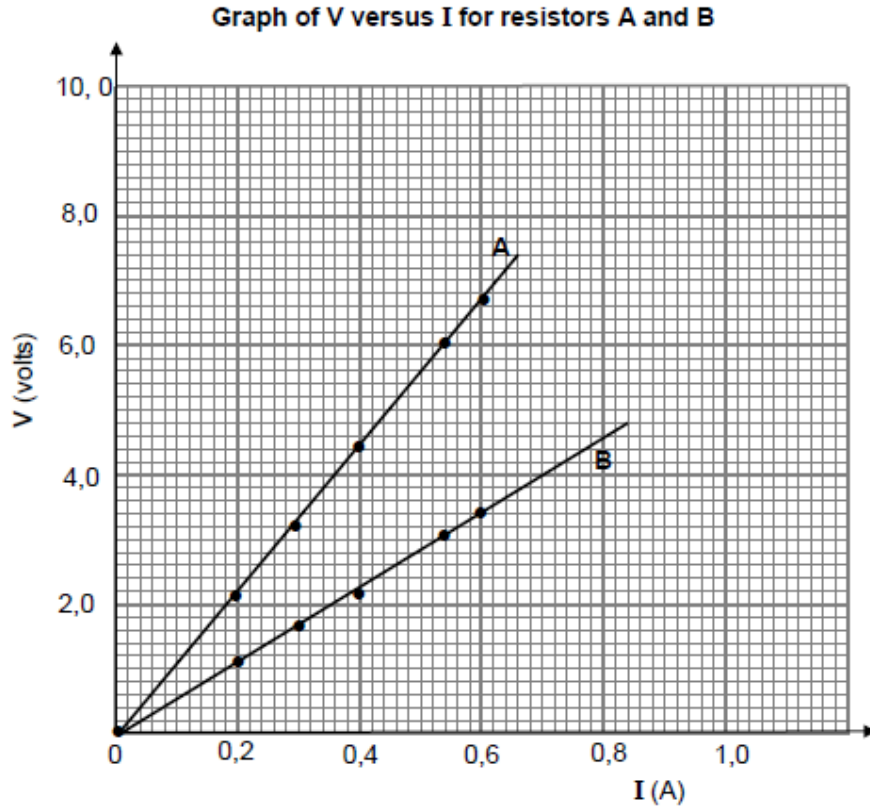
8.1. Define the term electric field at a point. (2)

8.2. Draw the electric field pattern around only the -20 nC charge. (2)

- 8.3. Determine the direction and magnitude of the **net electric field strength** at a point P. (5)
- 8.4. If an electron is placed at rest at P, in which direction will it move? Explain (2)
- [11]

Question 9

Learners want to construct an electric heater using one of two wires, **A** and **B**, of different resistances. They conduct experiments and draw the graphs as shown below.



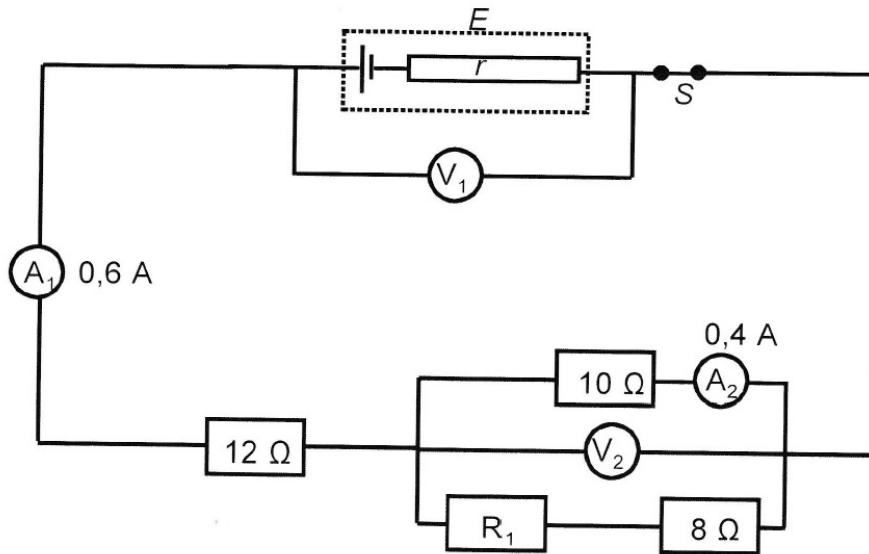
- 9.1. What type of conductors were used in this experiment? (1)
- 9.2. Apart from temperature, write down other two factors that the learners should keep constant to ensure a fair test when choosing a wire. (2)
- 9.3. Assuming all other factors are kept constant, which one of the two wires will be more suitable for the heater?

Use suitable calculation to show how you arrived at the answer. (7)

[10]

Question 10

Consider the following circuit.



When switch S is closed the reading on the meters are:

- V_1 decreases by 3V
- A_1 is 0,6 A
- A_2 is 0,4 A

The battery has an emf, E , and an internal resistance, r .

10.1. Calculate the:

- 10.1.1. Resistance of R_1 (6)
- 10.1.2. Internal resistance of the battery. (3)
- 10.1.3. Emf of the battery (6)
- 10.1.4. The power dissipated due to internal resistance of the battery. (3)

10.2. Calculate the cost of running the 12Ω for one 30 day month, if the tariffs are;

1kWh= R 1, 25 and the resistor is used for 3 hours daily. (7)

10.3. The 10Ω resistor burns out, how will the voltmeter reading V_1 change? Write INCREASE, DECREASE OR REMAIN THE SAME. Explain your answer. (4)

[29]

Section B: 132

Grand Total: 152

Bonus Question

Momentum

Question 11

A truck of mass 3 000 kg is travelling at $29,17 \text{ m}\cdot\text{s}^{-1}$ to the right. At the same time a car of mass 1 000 kg is travelling at $22 \text{ m}\cdot\text{s}^{-1}$ in the same direction ahead of the truck.



Ignore the effects of friction.

The truck collides with the car and they stick together after the collision.

- 11.1. State the principle of conservation of linear momentum in words. (2)
- 11.2. Calculate the velocity of the truck-car system immediately after collision. (5)
- 11.3. Is the collision between the truck and the car elastic or inelastic? (1)
- 11.4. On the impact the truck exerts a force of magnitude F and the car experiences acceleration of a .
 - 11.4.1. Will the magnitude of the force that the car exerts on the truck on impact be GREATER THAN, LESS THAN OR EQUAL TO F ? (1)
 - 11.4.2. Name and state the Law of physics that explains the answer in 11.4.1. (3)

[12]

