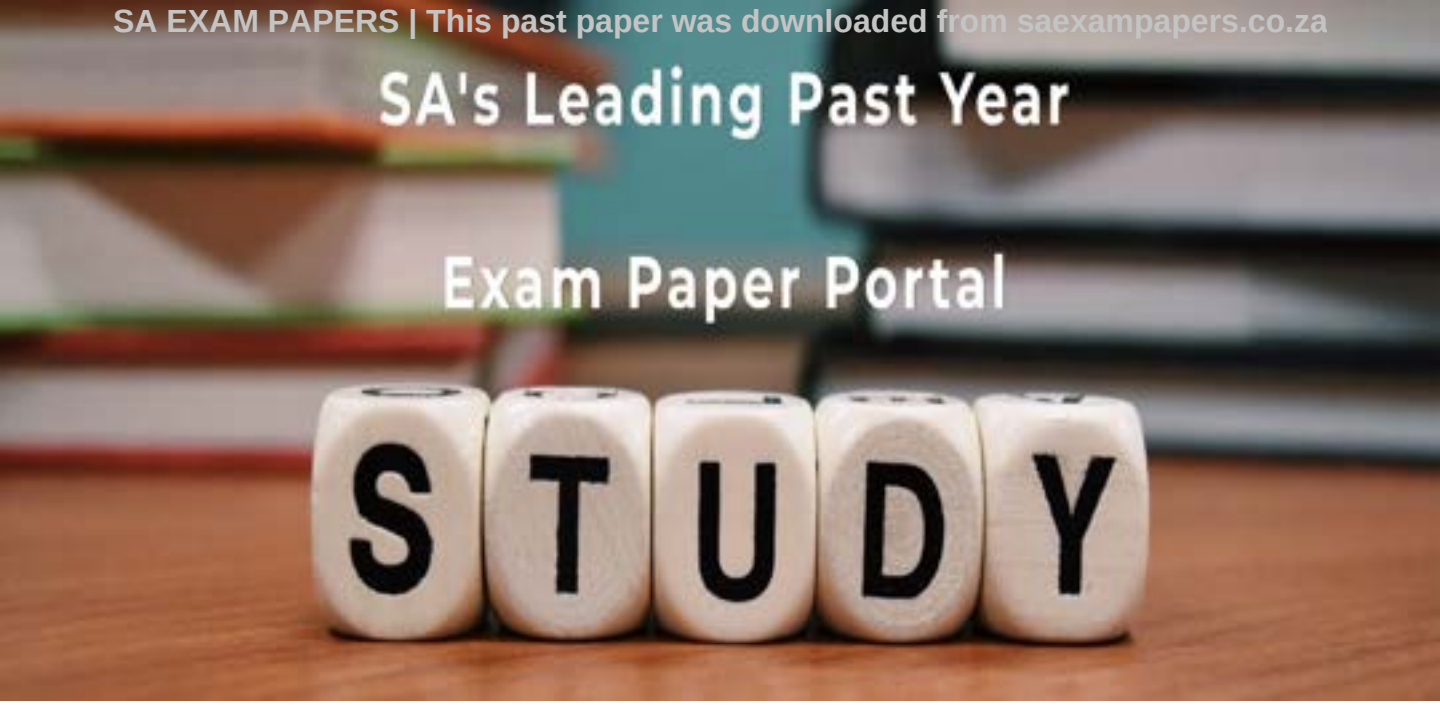


education

Department of
Education
FREE STATE PROVINCE

JUNE MOCK EXAMINATION

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2025

MARKS: 150

TIME: 3 HOURS

This paper consists of 14 pages and three information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of NINE questions. Answer ALL questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.
11. Give brief motivations, discussions, et cetera where 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. Choose the answer and write down only the letter A, B, C or D next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 Which one of the following has the smallest inertia?

A a 35 kg girl running up a slope.

B a 45 kg boy sliding on a frictionless ice.

C a box of 296 N rolling on a rough surface.

D a box of 512 N sliding on a smooth ground. (2)

1.2 A man standing on the earth surface has a mass of 80 kg and a weight of 784 N. If he is put in a satellite floating freely in space far from earth his mass and weight will be….

	MASS	WEIGHT
A	less than 80 kg	equal to 784 N
B	equal to 80 kg	more than 784 N
C	more than 80 kg	equal to 784 N
D	equal to 80 kg	less than 784 N

(2)

1.3 Two identical balls A and B each with mass of ***m*** kg and travelling with speed **v** $m.s^{-1}$, are moving towards each other. The balls have a head-on elastic collision.

Which statement is correct?

A the balls will stick together on impact.

B the total kinetic energy of the balls after collision is mv^2.

C the total kinetic energy of the balls during collison is mv^2.

D the total momentum of the balls before the collision is a non-zero. (2)

1.4 Rifle bullets, each with mass of **x** kg, are fired at the rate of **n** bullets per second on a wall. The magnitude of velocity of each bullet is **v** $m.s^{-1}$ and they rebound from the wall with the same velocity. The gravitational acceleration is **g** $m.s^{-2}$

The average force (in newtons) exerted on the wall will be……

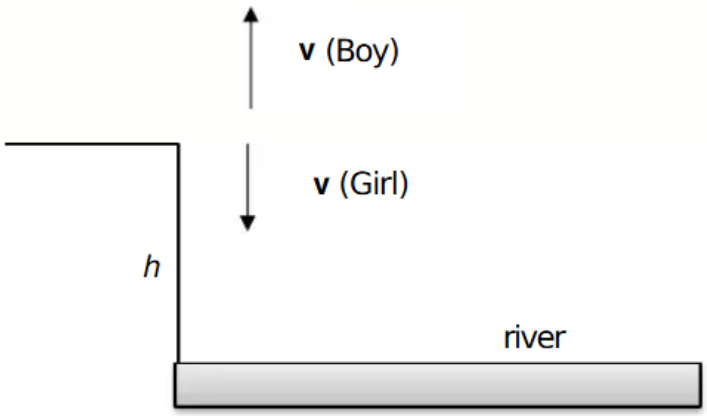
A **xnv**

B **xnvg**

C 2 **xnv**

D 2 **xnvg**

1.5 A boy and a girl stand on the edge of a cliff of height *h*. The girl throws a stone vertically downwards with speed **v** towards a river. Simultaneously, a boy throws a stone vertically upwards with the same speed **v** away from the river.



Neglecting air resistance. Which one of the following statements is true?

A The stone thrown by the girl will hit the river first and with a greater speed than the stone thrown by the boy.

B Both the stones will hit the river with the same speed only when both the stones have the same mass.

C The stone thrown by the girl will hit the river first because it has a smaller displacement.

D Both the stones will hit the river with the same speed regardless of the height of the cliff (2)

1.6 A trolley of mass 20 kg moves from position P to Q along a rough track. At point Q, its gravitational potential energy is **Y** J less than at point P. Its speed at point P is 2 $m \cdot s^{-1}$, and the work done against friction from P to Q is 60 J .?

Which of the following represent the magnitude of the velocity at point Q,

A $\sqrt{0.2(\mathbf{Y}-20)}\ m \cdot s^{-1}$

B $\sqrt{0.1(\mathbf{Y}-20)}\ m \cdot s^{-1}$

C $\sqrt{0.5(\mathbf{Y}-40)}\ m \cdot s^{-1}$

D $\sqrt{0.2(\mathbf{Y}-40)}\ m \cdot s^{-1}$ (2)

1.7 An astronomer observes light from two galaxies:

- Galaxy A is moving **away** from earth with a speed of v_A
- Galaxy B is moving **towards** earth with a speed of v_B

Both galaxies originally emitted light at frequency f_o. The observed frequencies of the light from each galaxy are f_A and f_B, respectively. If both galaxies are moving at low speeds, which of the following statements is correct about their observed frequencies?

A Both galaxies will appear red-shifted.

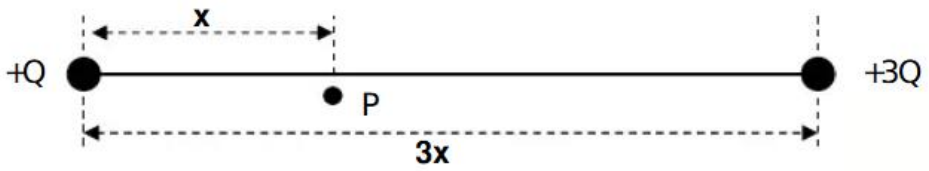
B The frequency of light from Galaxy A is lower than f_0, while the frequency from Galaxy B is higher than f_0.

C Both galaxies will appear blue shifted.

D The frequency of light from Galaxy A is higher than f_0, while the frequency from Galaxy B is lower than f_0.

(2)

1.8 Two charges +Q and +3Q are **3x** meters away from each other. When test charge q is placed at P it will.....



A move towards 3Q charge.

B move towards Q charge.

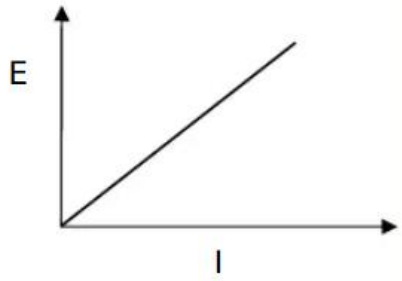
C remain where it is.

D move vertically downwards

(2)

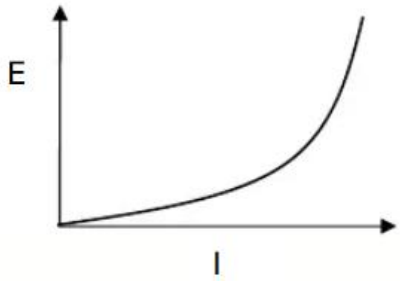
1.9 Which graph best represent the relationship between total energy transferred (E) and the electric current (I) in the heating element of a hairdryer.

A.

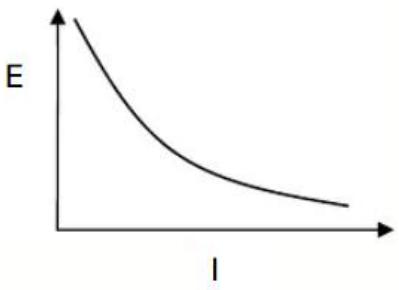


B.

C.

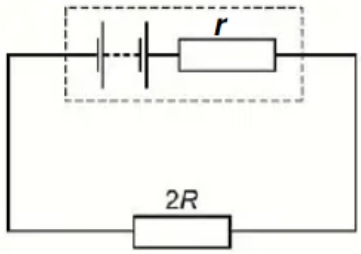


D.



(2)

1.10 The diagram below shows an electric circuit with an internal resistance of ***r*** and the resistance of the external resistor is 2R.



What is the ratio of $\frac{power\ in\ internal\ resistance}{power\ in\ external\ resistor}$?

A $\frac{1}{4}$

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

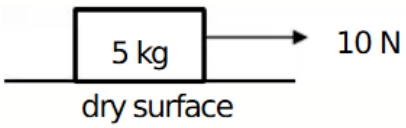
C 2

D 4

(2)
[20]

QUESTION 2

A learner drags a heavy box of mass 5 kg on a rough dry surface across the school hall floor with a force of 10 N. The box moves at a CONSTANT velocity of 0,5 m.s $^{-1}$ over the dry surface.



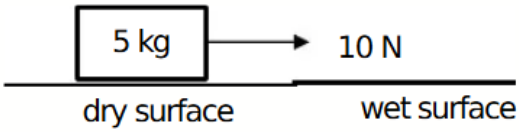
2.1 Define term kinetic friction in words. (2)

2.2 Draw the free body diagram of the box on the dry surface. (4)

2.3 What is the magnitude of friction acting on the box? (1)

2.4 Explain your answer in 2.3. (2)

2.5 When the box was dragged with the same 10N force across a rough wet surface in the school hall floor, the box velocity increased to 0,6 m.s $^{-1}$ in one second.



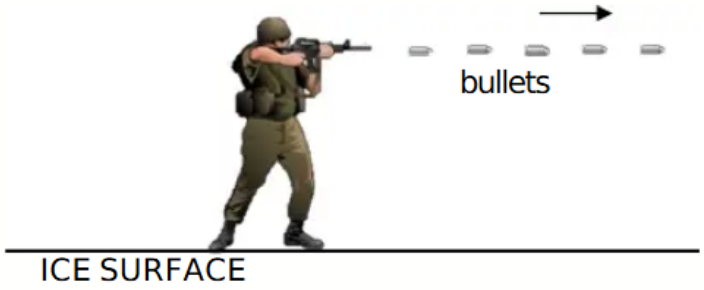
2.5.1 Calculate the magnitude of the coefficient of kinetic friction experienced by the box on the wet surface. (5)

2.5.2 Draw a graph that shows how coefficient of kinetic frictions and the force applied change across the dry and wet surface. (2)

[16]

QUESTION 3

A soldier holding a machine gun and bullets has a combined mass of 100 kg. He stands at rest on ice skating blades shoes and fires 10 bullets horizontally within 2 seconds in the forward direction. The firing makes the solider to recoil and moves slightly backwards. Each bullet has a mass of 10 g and leaves the machine gun with a speed of 720 $m.s^{-1}$. Assume there is no friction between the shoes and the ground.



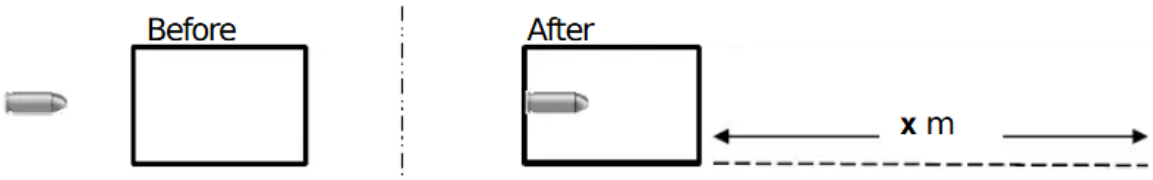
3.1 Define the term impulse. (2)

3.2 Name the Newtons law that makes the soldier to experience a recoil? (1)

3.3 Calculate the soldier speed after firing the 10^{th} bullet. (4)

3.4 Calculate the average force exerted on the soldier by his machine gun. (5)

3.5 One of the bullets hits a block of mass 550 g which is resting on a horizontal platform. The impact makes the bullet to be embedded in the block and together slide along the horizontal platform. The block and bullet system experiences a frictional force of 32 N throughout its motion.



3.5.1 Name the type of collision between the bullet and the block. (1)

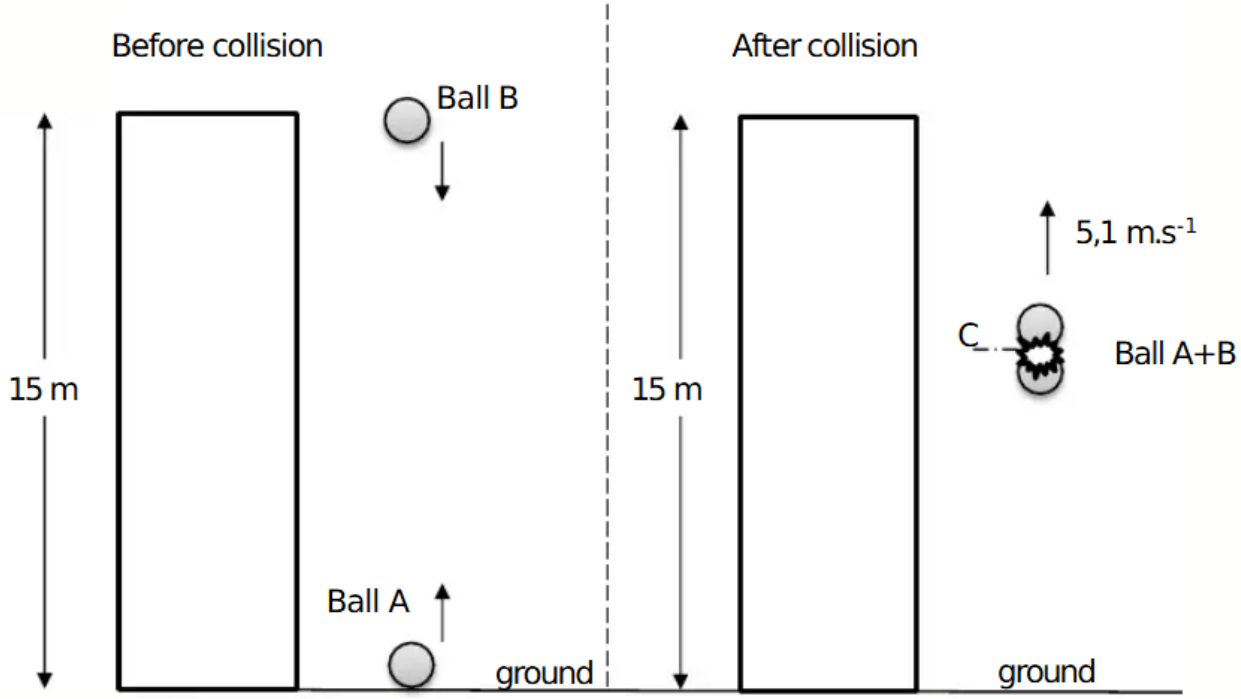
3.5.2 Calculate the distance **x** travelled by the block-bullet system before they come to a complete stop. (7)

3.5.3 How will the distance in 3.4.2 change if the platform is inclined upwards?
Write only INCREASE, DECREASE OR REMAIN THE SAME. (1)

3.5.4 Explain your answer in 3.5.3 (2)
[23]

QUESTION 4

Ball A is thrown straight up from the ground with an initial speed of 30 m.s $^{-1}$. At the same time, Ball B is dropped from a height of 15 meters above Ball A. After some time, Ball A and B collide at point C and stick together and move at velocity of 5,1 m.s^{-1} upwards. Ignore air friction.



4.1 Define the term projectile. (2)

4.2 Calculate the time at which Ball A and Ball B collide at point C (5)

4.3 Calculate the velocity of:

4.3.1 Ball A before collision at point C. (3)

4.3.2 Ball B before collision at point C. (2)

4.4 Calculate the maximum height reached by Ball A and Ball B above the ground after collision. (5)

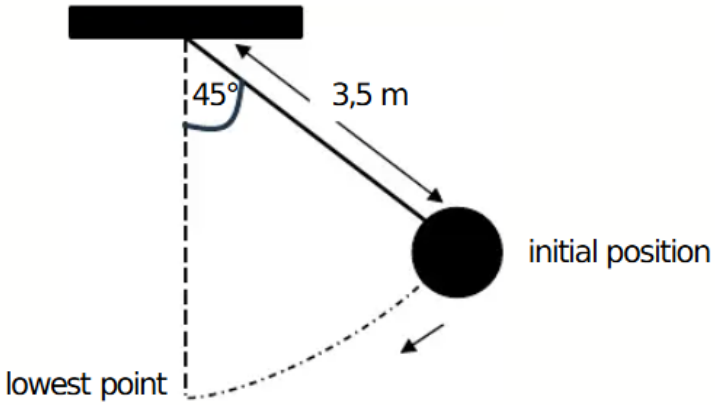
4.5 How long does it take for Ball A and Ball B to hit the ground after they have collided? (5)

4.6 Draw the graph of velocity (v) vs time (t) graph on the same set of axes for Ball A and Ball B before the collision and after the collision. (5)

[27]

QUESTION 5

A steel ball on a swinging rope has a mass of 20 kg. The rope is inextensible and has a length of 3,5 m. Initially the ball is held at an angle of 45 ° to the vertical and swings to its lowest point as shown below.



5.1 Define a term non-conservative force. (2)

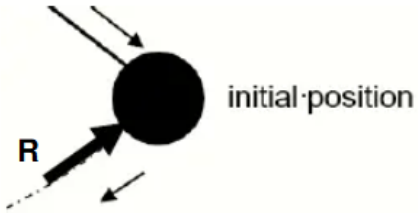
5.2 Calculate the gravitational potential energy at the initial position relative to its lowest position. (4)

5.3 Is total mechanical energy conserved? Write YES or NO. (1)

5.4 Explain your answer in 5.3. (2)

5.5 Calculate the speed of the steel ball when it has travelled HALFWAY along its path from its initial position to its lowest point. (5)

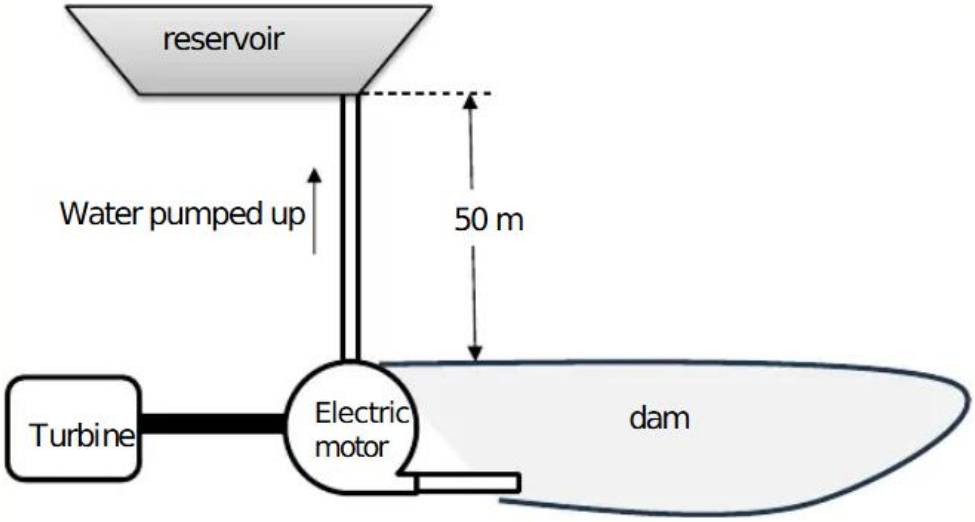
5.4 A resistance force **R** is now applied to slow down the motion of the steel ball. as shown below. The speed of the steel ball at its lowest position is 4 $m.s^{-1}$



Calculate the work done against the resistance force as the steel ball travels from its initial position to its lowest point. (4)
[18]

QUESTION 6

An electric motor drives a turbine that pumps water vertically upwards from a dam to a reservoir 50 m above the dam. The pump delivers 1 200 kg water in two minutes, and the water is delivered at a speed of 12 $m.s^{-1}$ at the reservoir.



6.1 Define the term average power in words. (2)

6.2 Calculate the average power of the electric motor. (6)
[8]

QUESTION 7

A sound wave of frequency 400 Hz is traveling through a medium where the wavelength of the sound wave is 0,85 m. A listener moves towards the source of the sound at a speed of 2 $m \cdot s^{-1}$ while the source is stationary.

7.1 Define the term Doppler effect. (2)

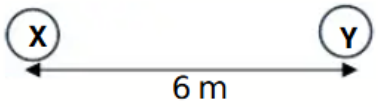
7.2 Calculate the speed of sound in the medium. (3)

7.3 Determine the frequency of the sound wave as detected by the listener moving towards the source. (3)

7.4 If the listener moves away from the source at the same speed, what frequency would they detect? (2)
[10]

QUESTION 8

Two charges **X** and **Y** with magnitudes +8 µC and -2 µC respectively are 6 m apart.



8.1 State *Coulomb's law* in words. (2)

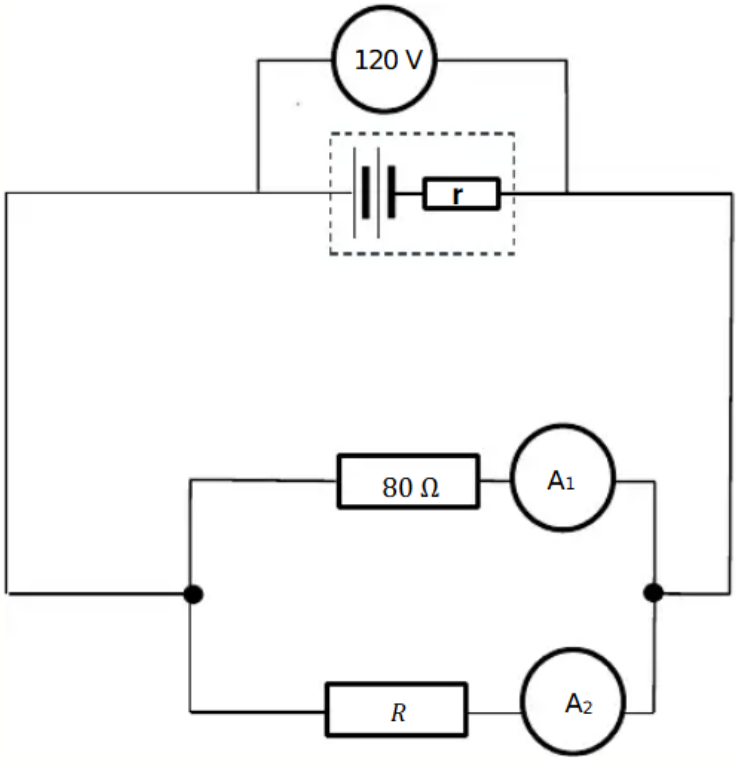
8.2 A third positive charge **Z** is placed along the horizontal line with charge **X** and **Y** such that it experiences a ZERO net electrostatic force.
Explain why this charge **Z** cannot be placed between charge **X** and **Y**, but must be placed outside. (2)

8.3 Calculate the distance where charge **Z** should be placed so that the net electrostatic force is ZERO. (6)

8.4 The polarity of charge **Z** now changes to negative. How will the equilibrium point shift? Write TOWARDS X or TOWARDS Y. Explain your answer (4)
[14]

QUESTION 9

The circuit diagram below shows a battery with an emf of 120 V and with internal resistance **r**. The reading on ammeter A_1 is 1,2 A and on ammeter A_2 is 0,40 A. Resistor R has a resistance larger than 80 Ω.



9.1 State *Ohm's law* in words. (2)

9.2 Without a calculation explain why the power output of the R is smaller than the power output of 80 Ω resistor? (2)

9.3 Calculate the:

9.3.1 the internal resistance **r**. (5)

9.3.2 the value of resistor R. (2)

9.4 If the 80 Ω resistor is replaced by a resistor with a larger resistor value of 120 Ω how will the reading on ammeter A_1 be affected?

Write INCREASE, DECREASE or REMAIN THE SAME. (1)

9.5 Explain your answer fully in 8.4. (2)
[14]

Total Marks: 150

DATA FOR PHYSICALSCIENCES GRADE12
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE
WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of the Earth *Radius van die Aarde*	R_E	6,38 x 10^6 m
Mass of the Earth *Massa van die Aarde*	M_E	5,98 x 10^{24} kg
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} J·s
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	m_e	9,11 x 10^{-31} kg

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/*of* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/*of* $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ or/*of* $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of* $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$W = F\Delta x\cos\theta$	$U = mgh$ or/*of* $E_P = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ or/*of* $W_{net} = \Delta E_k$ $\Delta K = K_f - K_i$ or/*of* $\Delta E_k = E_{kf} - E_{ki}$
$W_{nc} = \Delta K + \Delta U$ or/*of* $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{ave} = Fv_{ave}$ / $P_{gemid} = Fv_{gemid}$	

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ or/*of* $f_L = \frac{v \pm v_L}{v \pm v_b} f_b$	$E = hf$ or/*of* $E = \frac{hc}{\lambda}$
$E = W_0 + E_{k(max)}$ or/*of* $E = W_0 + K_{max}$ where $E = hf$ and $W_0 = hf_0$ and $E_{k(max)} = \frac{1}{2}mv_{max}^2$ or $K_{max} = \frac{1}{2}mv_{max}^2$	
$E = W_0 + E_{k(maks)}$ *of* $E = W_0 + K_{maks}$ *waar* $E = hf$ *en* $W_0 = hf_0$ *en* $E_{k(maks)} = \frac{1}{2}mv_{maks}^2$ *of* $K_{maks} = \frac{1}{2}mv_{maks}^2$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$	$E = \frac{kQ}{r^2}$
$V = \frac{W}{q}$	$E = \frac{F}{q}$
$n = \frac{Q}{e}$ or/*of* $n = \frac{Q}{q_e}$	

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$R = \frac{V}{I}$	emf (ε) = I(R + r) emk (ε) = I(R + r)
$R_s = R_1 + R_2 + \ldots$ $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$q = I\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

ALTERNATING CURRENT/*WISSELSTROOM*

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$ / $I_{wgk} = \frac{I_{maks}}{\sqrt{2}}$	$P_{ave} = V_{rms}I_{rms}$ / $P_{gemiddeld} = V_{wgk}I_{wgk}$ $P_{ave} = I_{rms}^2R$ / $P_{gemiddeld} = I_{wgk}^2R$
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ / $V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$	$P_{ave} = \frac{V_{rms}^2}{R}$ / $P_{gemiddeld} = \frac{V_{wgk}^2}{R}$