LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2026

MARKS: 150

TIME: 3 HRS

MYEPHSCP1

This question paper consists of 17 pages and 3 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your NAME in the appropriate space on the ANSWER BOOK
2. This question paper consists of 9 questions. Answer ALL the 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, e.g. between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable 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.
11. Give brief motivations, discussions et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE CHOICE QUESTIONS

Choose one correct option and only write the letter next to the question number in the answer book. (e.g. 1.11 B)

1.1 The velocity of a body (which may be zero) remains constant as long as the body is isolated from the rest of the universe. This statement illustrates...

A Newton's First Law of Motion.

B Newton's Second Law of Motion.

C Newton's Third Law of Motion.

D Newton's Law of Universal Gravitation. (2)

1.2 Which ONE of the following CORRECTLY represents **the mathematical relationship between the gravitational acceleration (g) near the** surface of a planet and the mass (**M**) of that planet?

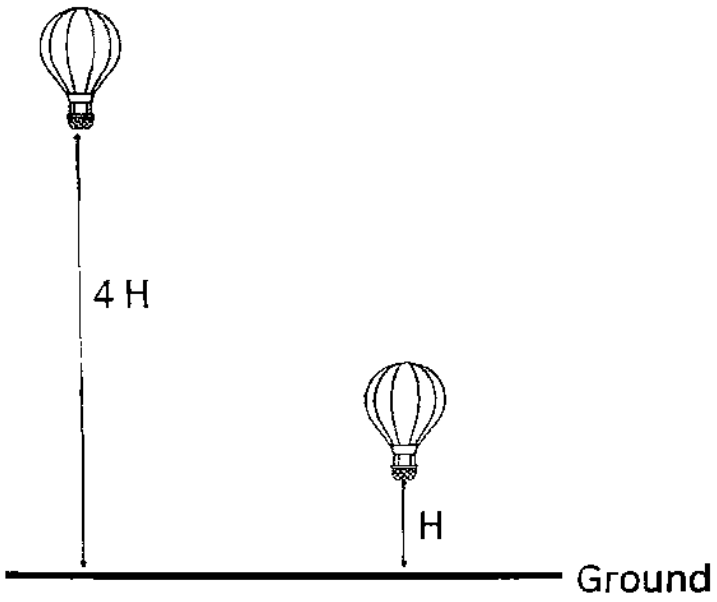
A $g \propto 2M$

B $g \propto M$

C $g \propto \frac{1}{M}$

D $g \propto \frac{1}{2M}$ (2)

1.3 An object is dropped from two different heights, as indicated in the following diagram:



When dropped from a height **4H** above the ground, the object takes **t** seconds to reach the ground.
The time that the object takes when dropped from a height **H** is...

A $\frac{1}{16}$ t seconds

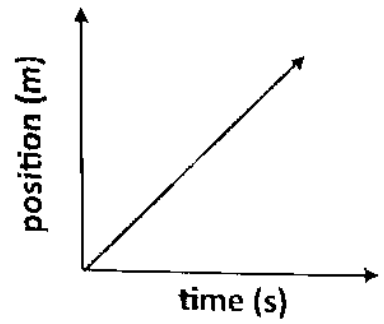
B $\frac{1}{4}$ t seconds

C $\frac{1}{2}$ t seconds

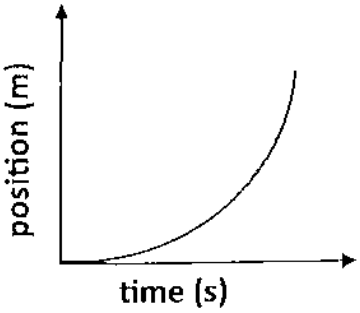
D t seconds (2)

1.4 Which ONE of the following sketch graphs shows the relationship between position and time of a freely falling body?

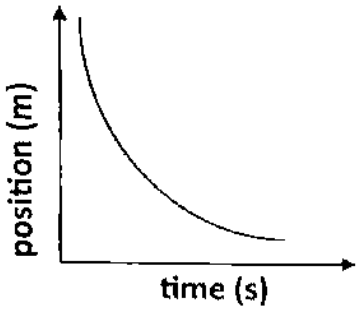
A



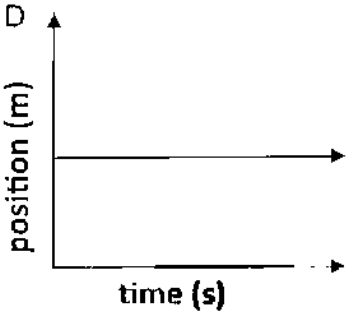
B



C

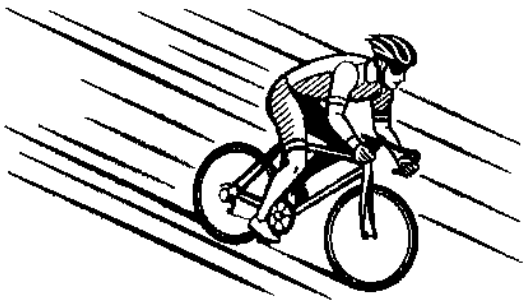


D



(2)

1.5 The following diagram shows a cyclist on a bicycle going down a hill WITHOUT pedalling.



Which expression can be used to calculate the work done by friction?

A ΔE_k

B $\Delta E_k + \Delta E_p$

C $F_{net} \Delta h \cos\theta$

D $\Delta E_k - \Delta E_p$

(2)

1.6 A source of sound with a frequency 620 Hz is placed on a moving platform that approaches a learner at a speed **v**. The learner hears a sound with frequency f_1. Then the source of sound is held stationary while the learner approaches it at the same speed of **v**. The learner now hears a sound with a frequency f_2. Which ONE of the following mathematical statements is CORRECT?

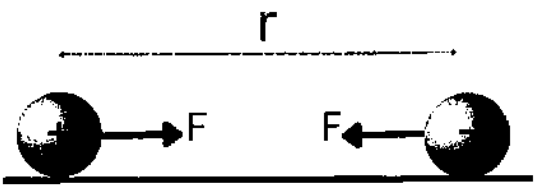
A $f_1 = f_2 > 620$ Hz

B $f_1 > f_2 > 620$ Hz

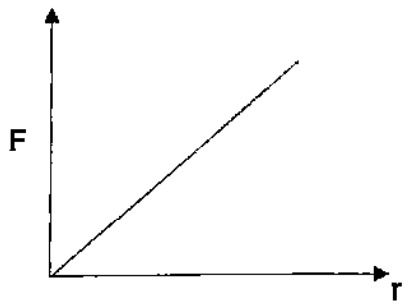
C $f_1 < f_2 > 620$ Hz

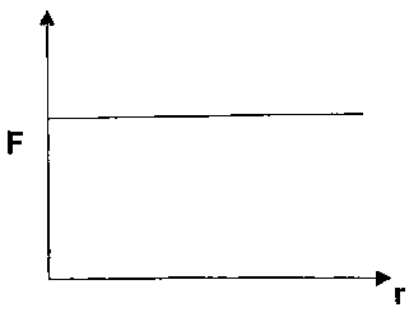
D $f_2 > f_1 > 620$ Hz (2)

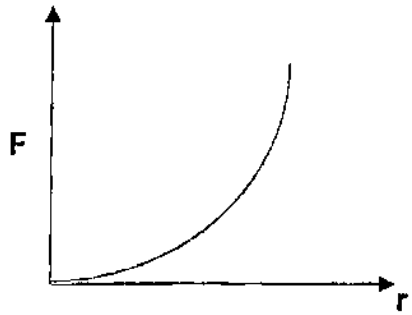
1.7 Two oppositely charged spheres are kept in place at a distance of **r** metres on an isolated surface as shown in the following diagram:

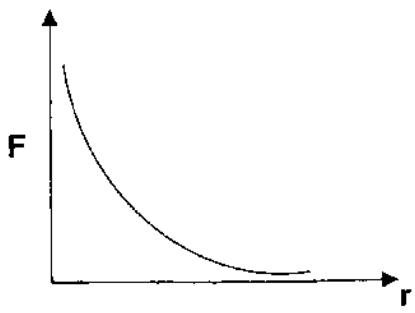


Which ONE of the following sketch graphs BEST illustrates the relationship between the electrostatic force (**F**) and distance (**r**)?

A


B


C


D


(2)

1.8 A positive point charge (+Q) creates an electric field. At a certain point **X**, the field is directed away from the charge and has a magnitude of 20 $N \cdot C^{-1}$. If a negative test charge is placed at point **X**, what happens to it and the electric field?

A the test charge experiences a force away from the positive charge, and the electric field at point **X** remains 20 N C^{-1}

B the test charge experiences a force away from the positive charge, and the electric field at point **X** increases

C the test charge experiences a force towards the positive charge, and the electric field at point **X** becomes zero

D the test charge experiences a force away from the positive charge, and the electric field at point **X** decreases (2)

1.9 A kettle has a 1 200 W power rating and is used for 15 minutes every day in a month with 30 days. The electricity tariff is R3,15 per kWh. The cost for using the kettle is

A R 283,50

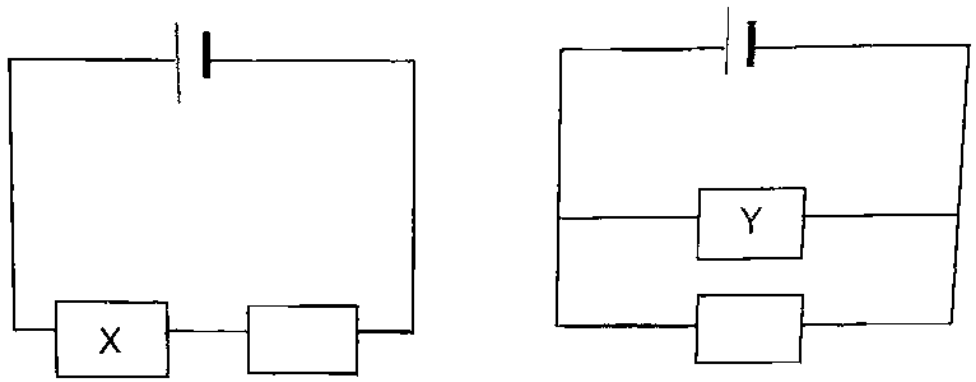
B R 28,35

C R1 701,00

D R17,01

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1.10 In the following circuit diagrams the cells and resistors are IDENTICAL. The cells and connecting wires have negligible resistance.



If the power dissipated in resistor **X** is **P**, then the power dissipated in resistor **Y** is...

A $\frac{1}{4}$**P**.

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

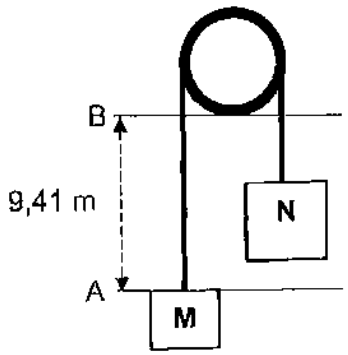
C 2**P**.

D 4**P**. (2)

[20]

QUESTION 2 (Start on a new page)

The diagram below shows two objects, **M** and **N**, connected by a light, inextensible string passing over a frictionless pulley. **N** has a mass TWICE that of **M**.



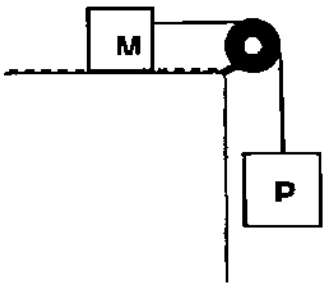
The two objects are initially held at rest with **M** at point **A.** The system is NOW released and move until **M** reaches point **B**, 9,41 m above point **A**, in 2,4 s.
Neglect all effects of friction or rotation of the pulley.

2.1 State, in words, *Newton's Second Law of motion* in terms of acceleration. (2)

2.2 Draw a free body diagram of object **M** whilst in motion. (2)

2.3 Calculate the acceleration of the system WITHOUT using equations of motion. (5)

Object **N** is disconnected from object **M** and is now connected to object **P** (of mass 7 kg) on a ROUGH, horizontal surface, as the diagram below illustrates.



The kinetic friction coefficient between the surface and **M** is 0,17. **M** accelerates at 0,42 $m \cdot s^{-2}$ to the right.

2.4 Calculate the mass of **M.** (6)

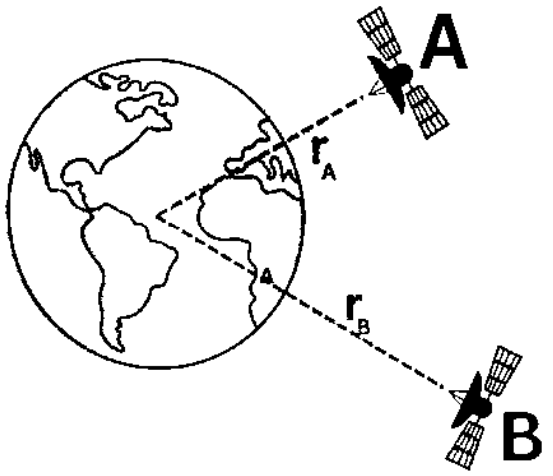
Assume the kinetic friction coefficient between the surface and object **M** is INCREASED.

2.5 How will this change affect the tension in the string? Choose from INCREASE, DECREASE or REMAIN THE SAME. Fully explain the answer. (3)
[18]

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QUESTION 3 (Start on a new page)

The diagram below shows the presence of two satellites above the surface of the Earth that experience EQUAL gravitational forces. The distance of satellite **B** ABOVE the surface of the Earth is TWICE that of satellite **A**. Satellite **A** has a mass of 1 200 kg and Satellite **B** has a mass of 2 500 kg.



3.1 Describe the term *weight* in words. (2)

3.2 Calculate the distance of satellite **A** above the surface of the Earth. (6)

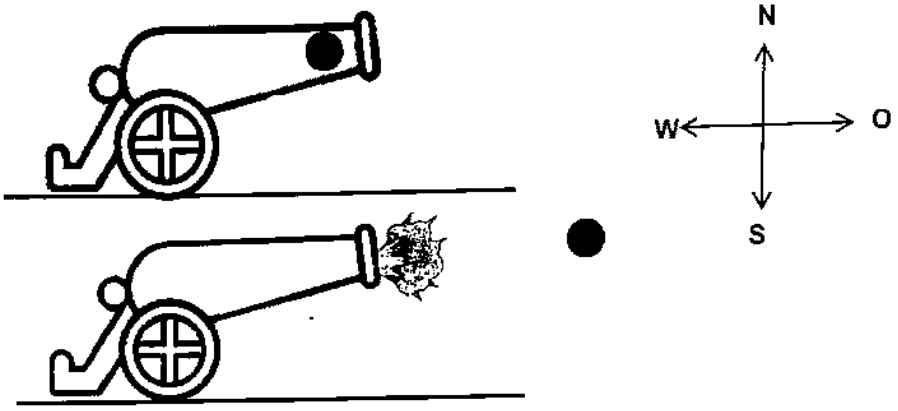
3.3 Compare the gravitational force of the Earth on satellite **C** with that of **A**, if **C** has a mass that is DOUBLE that of satellite **A** and they are at the SAME height above the Earth.
Only choose from DOUBLED, HALVED or QUADRUPLED. Suggest a reason for the answer. (2)

[10]

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QUESTION 4 (Start on a new page)

A free-standing cannon with a mass of 120 kg is loaded with a 4,5 kg cannonball. It is fired and the cannonball leaves the barrel at a velocity of 95 $m \cdot s^{-1}$ directly EAST.



Neglect any frictional effects.

4.1 Define the term *momentum* in words as applied in Physics. (2)

4.2 Calculate the velocity of the cannon JUST after the cannonball leaves the cannon. (4)

4.3 State *Newton's second law of motion in terms of momentum*, in words. (2)

4.4 Calculate the:

4.4.1 Impulse on the cannon during the explosion (4)

4.4.2 Frictional force that will bring the cannon to a complete stop in 2,5 s (3)

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The following diagram shows a bowler releasing a bowling ball during ten pin bowling. The ball in this experiment has a mass of 3,5 kg and leaves the player's hand with a horizontal velocity of 7 $m \cdot s^{-1}$ to the right.



The bowling ball reaches the pin with a velocity of 6,7 $m.s^{-1}$ after 2,5 s.

4.5 Calculate the frictional force exerted by the ground during the motion of the ball from the person to the pins. (4)

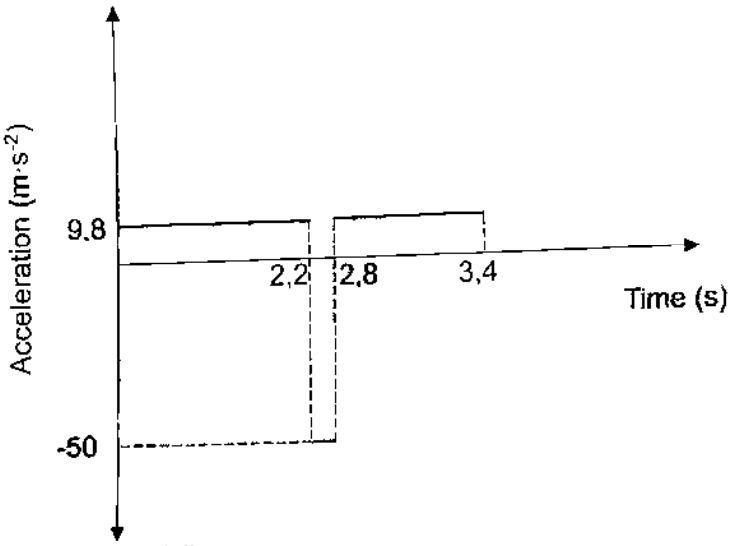
4.6 The ball hits a single pin which shoots forward with a horizontal velocity of 4.24 $m.s^{-1}$. The ball has a final velocity of 6,22 $m.s^{-1}$ **after the** collision. Calculate the mass of the pin by using the **PRIN**CIPLE OF CONSERVATION OF MOMENTUM. (4)

[23]

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QUESTION 5 (Start on a new page)

The acceleration-versus-time sketch graph below illustrates the motion of an object dropped FROM REST from a point **P** above the ground.



The object undergoes free fall.

5.1 Define *free fall.* (2)

5.2 Explain the movement of the object from zero seconds until 3,4 s. (3)

5.3 Calculate:

5.3.1 The velocity at 2,2 seconds (3)

5.3.2 The height from which the object was dropped (3)

5.3.3 The velocity of the object at 3,4 seconds (5)

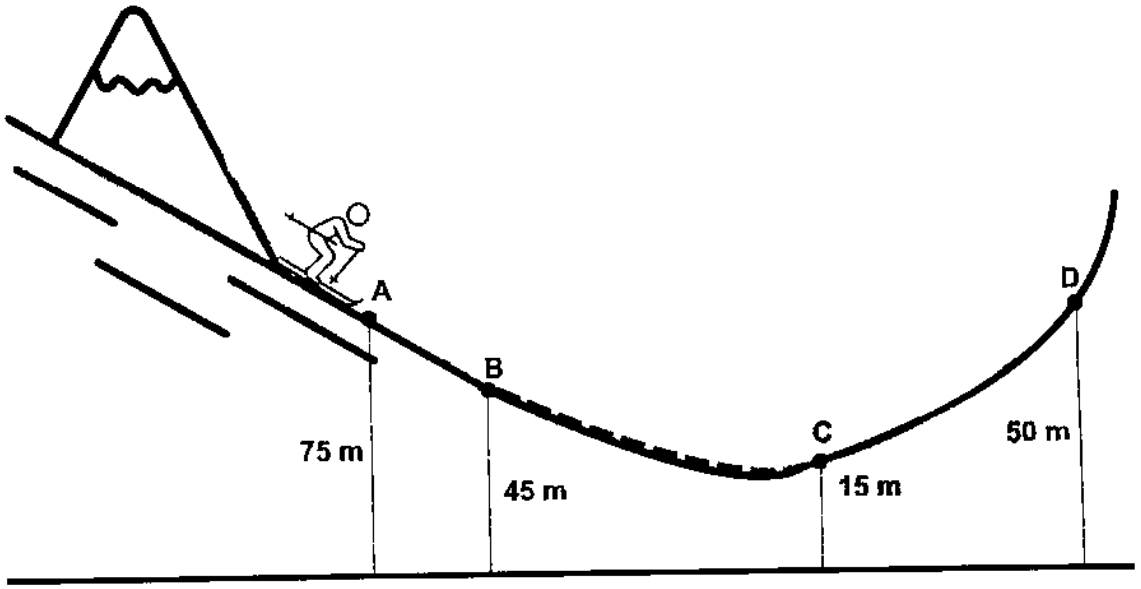
5.4 Sketch a corresponding velocity-versus-time graph for the motion of the object. Clearly show the numerical values for the following on the graph:
- velocity at 2,2 s
- velocity at 2,8 s
- velocity at 3,4 s

(5)
[21]

QUESTION 6 (Start on a new page)

A Skier with mass of 65 kg, skis down a hill. He/she passes point **A**, at a height of 75 m above the horizontal, at a speed of 4 $m \cdot s^{-1}$ and enters a ROUGH portion from points **B** to **C**. Point **B** is at a height of 45 m and **C** is at 15 m. The skier stops at point **D**, as shown in the diagram below.

The sketch diagram is NOT drawn to scale.



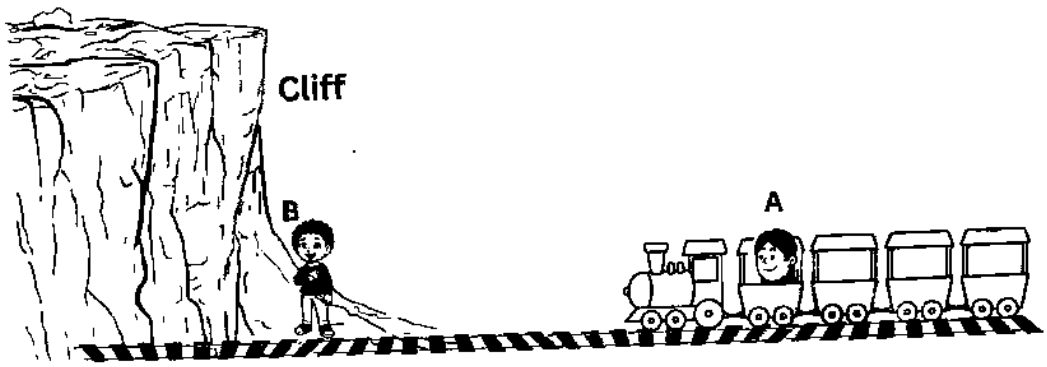
6.1 Define a *conservative force* in words. (2)

6.2 Draw a free-body diagram of the skier just before point **C**. (3)

6.3 USING ENERGY PRINCIPLES ONLY, calculate the work done by the frictional force from point **B** to point **C**. (7)
[12]

QUESTION 7 (Start on a new page)

A person (**A**) is on a train that is approaching a cliff. His/her friend, **B**, is waiting at the foot of the cliff for the train to pass. The train's horn produces a sound with a frequency of 370 Hz and the conductor blows the horn as they approach at a constant speed of 19,4 $m \cdot s^{-1}$.



7.1 NAME the wave phenomenon responsible for the change **in frequency** observed by person **B**. (1)

7.2 Calculate the frequency of the horn that will be observed by person **B** as the train approaches. (3)

7.3 Person **B** responds by blowing on a whistle with a frequency of 2 000 Hz as the train **moves away** from him/her. Calculate the frequency that person **A** will observe. (3)

7.4 Without any calculations, predict what would happen to the value calculated in QUESTION 7.3 if the speed of the train was HIGHER.

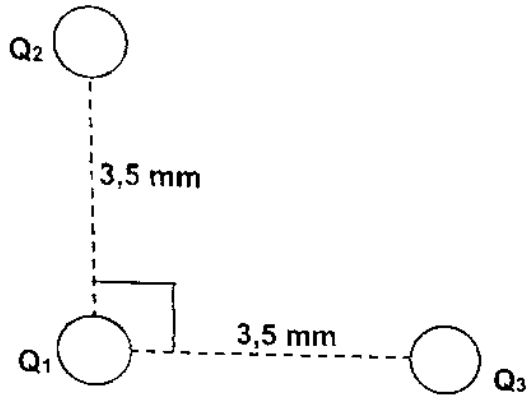
Choose HIGHER THAN, LOWER THAN or REMAIN THE SAME. (1)

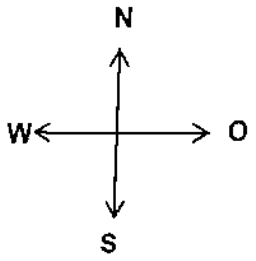
7.5 State the NAME and EXPLAIN the effect of the Doppler effect that is used to prove the following statement: *"The universe is expanding."* (3)

[11]

QUESTION 8 (Start on a new page)

The charges on three IDENTICAL metal spheres are Q_1 = -12 μC, Q_2 = +4 μC, and Q_3 = +2,0 μC. The spheres are brought together so they simultaneously touch each other. They are then separated and placed as shown in the diagram below.





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

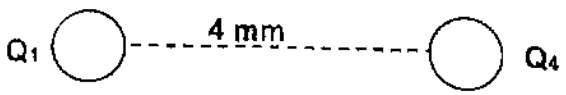
8.2 Is the net charge on the system comprising the three spheres the same BEFORE and AFTER touching? State only YES or NO. (2)

8.3 Do Q_2 and Q_3 exert forces of equal magnitude on Q_1? Answer only YES or NO. (2)

8.4 Calculate the magnitude of the NET force exerted on Q_1 due to the presence of Q_2 and Q_3. (5)

Spheres Q_2 and Q_3 are NOW removed.

Another sphere carrying a charge of Q_4 = +2,0 μC, is placed 4 mm to the right of Q_1, as shown in the diagram below.



8.5 Define *electric field at a point.* (2)

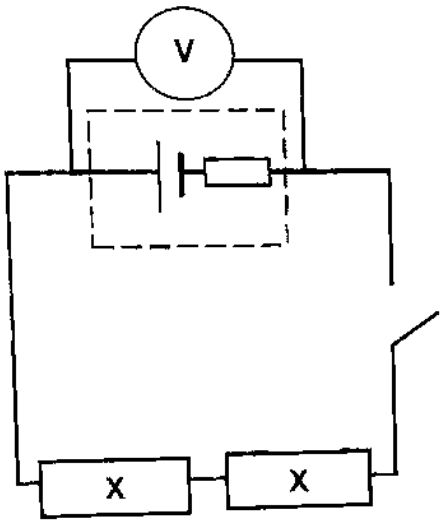
8.6 Calculate the NET electric field at a point MIDWAY between Q_1 and Q_4. (6)

[19]

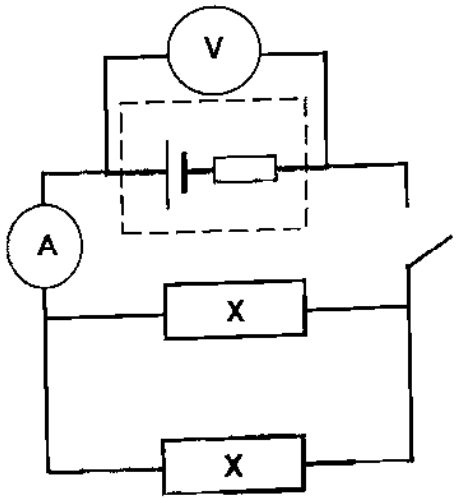
QUESTION 9 (Start on a new page)

Physics learners are instructed to determine the internal resistance of a cell. They set up the circuits for their investigations as the diagrams below illustrate.

CIRCUIT A



CIRCUIT B



The cells are identical, and the resistors are identical also.

The results obtained are shown in the following table:

VOLTMETER READINGS (V)		
	Circuit A	**Circuit B**
Switch open	7,5	P
Switch closed	6,78	5,25

9.1 Define the term *emf*, in words. (2)

9.2 Write down the numerical value of **P**, shown in the table above. (2)

9.3 When the switch in circuit **B** is closed, the ammeter reads 7,01 A.

9.3.1 Calculate the resistance of a single resistor. (5)

9.3.2 Explain why the voltmeter reading in **Circuit B** is lower than that of **Circuit A.** Refer to *total resistance*, *current* and *internal resistance* in the explanation. (4)

9.3.3 Calculate the power dissipation in **one** of the resistors from **Circuit A.** (3)

[16]

GRAND TOTAL: 150

DATA FOR PHYSICAL S

CIENCES GRADE 12
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS/*FISIESE KONSTANTES*

NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Acceleration due to gravity *Gravitasieversnelling*	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant *Universele gravitasiekonstante*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
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} $J \cdot s$
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron *Lading op 'n elektron*	e	1,6 x 10^{-19} C
Electron mass *Massa van elektron*	m_e	9,11 x 10^{-31} kg
Mass of the Earth *Massa van die Aarde*	M	5,98 x 10^{24} kg
Radius of the Earth *Radius van die Aarde*	R_E	6,38 x 10^6 m
Speed of sound in air *Spoed van klank in lug*	v	340 $m \cdot s^{-1}$

TABLE 2: FORMULAE/*FORMULES*

MOTION/*BEWEGING*

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

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$ OR $F = \frac{Gm_1m_2}{r^2}$	$g = \frac{GM}{d^2}$ OR $g = \frac{GM}{r^2}$

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

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

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

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$	$E = hf$ OR $E = h\frac{c}{\lambda}$
$E = W_o + E_{k(max)}$ OR $E = W_o + K_{max}$	$E = W_0 + E_{k(maks)}$ OF $E = W_0 + K_{maks}$
$E = hf$ and/en $W_0 = hf_0$ and $E_{k(max)} = \frac{1}{2}mv_{max}^2$ OR $K_{max} = \frac{1}{2}mv_{max}^2$	

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 $n = \frac{Q}{q_e}$	

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*

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$	$I_{wgk} = \frac{I_{maks}}{\sqrt{2}}$	$P_{ave} = V_{rms}I_{rms}$	$P_{gem} = V_{wgk}I_{wgk}$
		$P_{ave} = I^2_{rms}R$	$P_{gem} = I^2_{wgk}R$
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$	$V_{wgk} = \frac{V_{maks}}{\sqrt{2}}$	$P_{ave} = \frac{V^2_{rms}}{R}$	$P_{gem} = \frac{V^2_{wgk}}{R}$