education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)

JUNE 2026

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages and 2 data sheets.

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INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER BOOK.
2. This question paper consists of TEN 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 open between two subquestions, e.g. QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. You are advised to use the attached DATA SHEETS.
11. Write neatly and legibly.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.11 E.

1.1 Which ONE of the following S.I units is equivalent to a newton (N).

A $kg.m.s^{-1}$

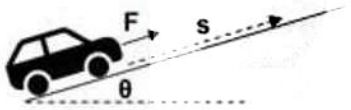
B $kg.m.s^{-2}$

C $kg.m.s^{2}$

D $kg.m^{2}.s^{-2}$ (2)

1.2 A car of mass **m** drives at a constant velocity **v** up a slope that makes an angle of **θ** to the horizontal. There is a driving force, **F**, acting on the car up the slope, as shown in the diagram below.

When the car moves a distance **s** up the slope, what is the component of the weight acting perpendicular to the surface:



A mgsin θ

B mgcos θ

C Fcos θ

D Fsin θ (2)

1.3 A 5 kg ball moving at 4 $m.s^{-1}$ collides with a stationary 3 kg ball. If the collision is perfectly elastic, what is the combined velocity after the collision?

A 4,5 $m.s^{-1}$

B 1,5 $m.s^{-1}$

C 2,5 $m.s^{-1}$

D 2 $m.s^{-1}$ (2)

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1.4 Ball **X** of mass **m** is projected vertically upwards from a bridge 30m high with an initial velocity of $\mathbf{V_x}$. Ball **Y** of mass **2m** is thrown vertically downwards from the same bridge with the velocity of $\mathbf{V_y}$. The two balls reach the ground at the same speed. Ignore the effect of air resistance.

Which ONE of the following is CORRECT regarding the velocities with which the balls are projected?

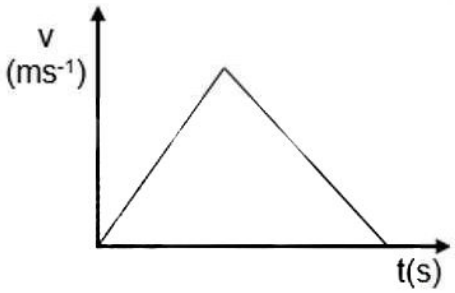
A $V_x = 0{,}5V_y$

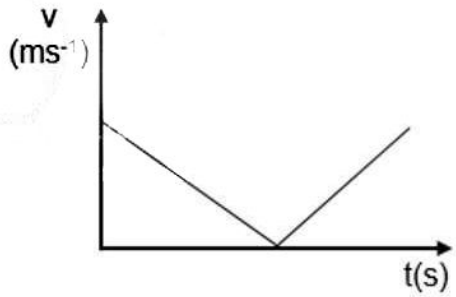
B $V_x = V_y$

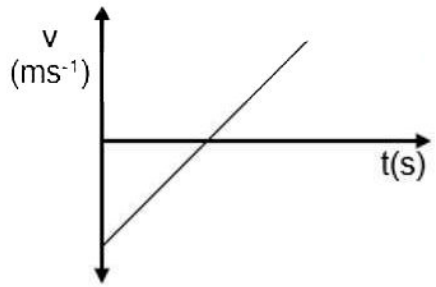
C $V_x = 2V_y$

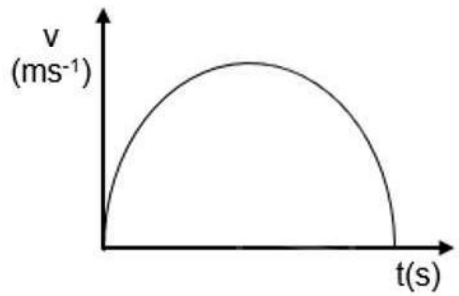
D $V_x = 4V_y$ (2)

1.5 A girl throws a tennis ball vertically upwards, and after some time it returns to the girl's hands. Which ONE of the following velocity versus time graphs best represents the motion of the tennis ball? Ignore air friction.

A 

B 

C 

D 

(2)

1.6 A car moves at a speed of **v** and has a kinetic energy E_k. If the speed of the car increases to 2**v**, the kinetic energy will then be …

A $2\ E_k$

B $4\ E_k$

C $8\ E_k$

D $16\ E_k$ (2)

1.7 The power output of an engine is increased so that the same amount of work is done in one-third of the original time.

The ratio of the new power to the original power is:

A 1 : 3

B 3 : 1

C 1 : 9

D 9 : 1 (2)

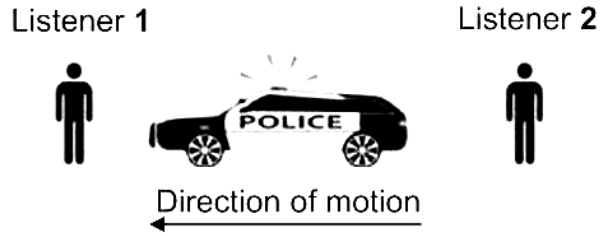
1.8 A pedestrian is waiting at a traffic light. A police car with its siren switched on is speeding towards the pedestrian.

Which ONE of the following correctly describes the relationship between frequency and wavelength detected by the pedestrian?

	Frequency	**Wavelength**
A	Higher	Longer
B	Higher	Shorter
C	Lower	Shorter
D	Lower	Longer

(2)

1.9 The diagram below shows a police car with its siren blaring, stationed between two stationary listeners.



While the police car is stationary, how does the frequency detected by listener **1** compare to the frequency detected by listener **2**.

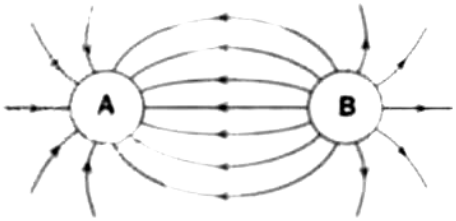
A No detection

B Greater than

C Less than

D Equal to (2)

1.10 The electric field pattern between two charged spheres, **A** and **B**, is shown below.



Which ONE of the following statements regarding the charges on spheres **A** and **B** is CORRECT?

A Spheres **A** and **B** are both positively charged.

B Spheres **A** and **B** are both negatively charged.

C Sphere **A** is positively charged, and sphere **B** is negatively charged.

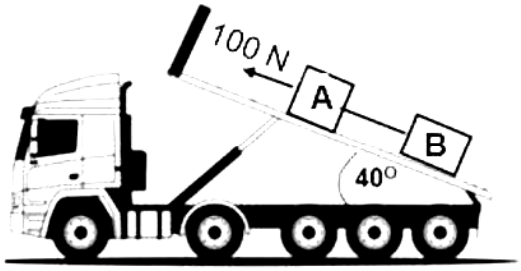
D Sphere **A** is negatively charged, and sphere **B** is positively charged. (2)

[20]

QUESTION 2 (Start on a new page.)

Two blocks, **B**, of mass 20 kg, and **A**, of mass 10 kg, are connected by a light inextensible string. The blocks are lowered down on a rough inclined dump bed which is at an angle of 40°.

The contractor applies an upwards force of 100N, parallel to the surface of the dump bed for the blocks not to break. The coefficient of kinetic friction between each block and the surface of the dump bed is 0,2.



2.1 Define the term *kinetic frictional force*. (2)

2.2 Calculate the magnitude of the frictional force acting on Block **B** as it slides down the surface of the dump bed. (3)

2.3 Draw a labelled free-body diagram showing all the forces acting on Block **A** as it slides down the surface of the dump bed. (5)

2.4 Calculate the magnitude of:

2.4.1 Kinetic frictional force acting on block **A** as it slides down the dump bed. (2)

2.4.2 Tension in the string connecting the two blocks. (8)

2.5 The contractor stops applying the 100 N force to the blocks. What will happen to acceleration?

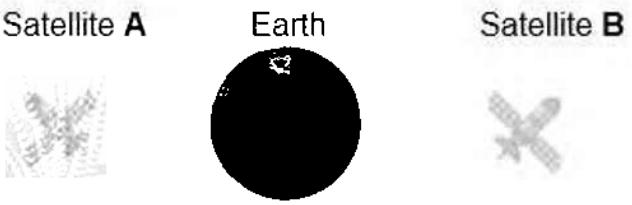
Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)
[21]

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QUESTION 3 (Start on a new page.)

Two satellites, **A** and **B**, orbiting the Earth and are situated on opposite sides of the Earth. Satellite **A** has a mass of 4 500 kg and Satellite **B** has a mass of 3 800 kg.

The force between satellite **B** and the Earth is 1 539,23 N.



3.1 State Newton's Law of Universal Gravitation in words. (2)

3.2 Explain the term *weightlessness*. (2)

3.3 Calculate the distance(r) between the centre of the Earth and Satellite **B**. (4)

3.4 What distance above the surface of the Earth should Satellite **A** be to experience the same force towards the Earth as Satellite **B**?

Choose from GREATER THAN, LESS THAN or EQUAL TO the distance of satellite **B** above the Earth.

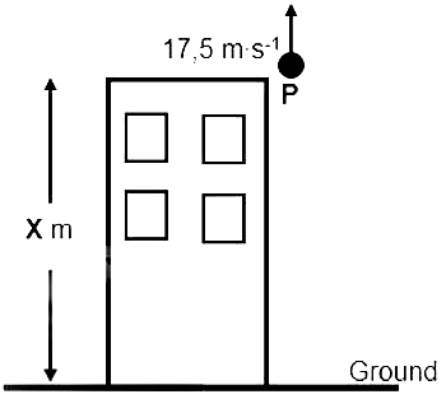
Explain the answer WITHOUT the use of a calculation. (4)
[12]

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QUESTION 4 (Start on a new page.)

Ball **P** is projected vertically upwards from a height, **X** m, with a speed of 17,5 $m \cdot s^{-1}$. The ball strikes the ground after 5 s, with a speed of **V**.

Ignore the effects of air friction.



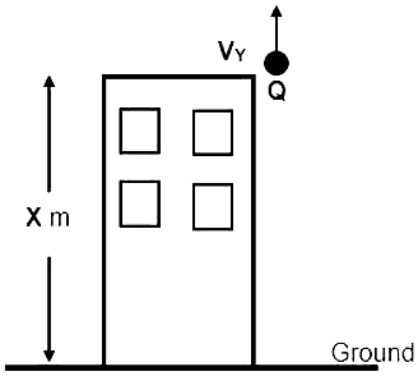
4.1 Define the term *projectile*. (2)

4.2 Calculate the:

4.2.1 The value of **X** (3)

4.2.2 Speed **V** with which the ball hits the ground (3)

A second ball **Q** is thrown vertically upwards from the same height **X** m with a speed of $\mathbf{V_Y}$, until it strikes the ground with a speed of $\frac{6}{7}$ **V**.



4.3 Calculate the value of $\mathbf{V_Y}$. (5)

4.4 Draw a position-time graph for ball **Q** from the moment it was vertically thrown upwards until it strikes the ground.

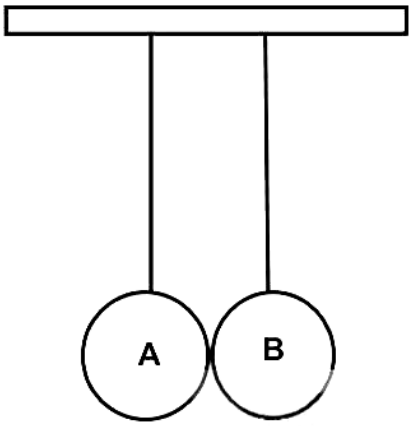
Take the ground as the zero position. (2)
[15]

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QUESTION 5 (Start on a new page.)

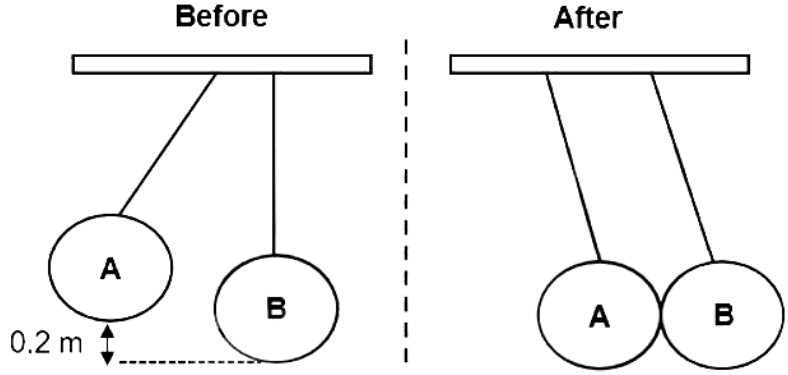
Two small plastic balls, **A** and **B** at rest, are suspended vertically from the ceiling by identical light inextensible strings.

Ball **A** has a mass of 0,4 kg and ball **B** has a mass of 0,6 kg.



Ball **A** is pulled horizontally to the left, so that its centre of mass is raised 0,2 m above its original equilibrium position. It is then released from rest. Ball **A** swings downwards and collides with ball **B**, which was initially at rest. The two balls swing together after collision.

Ignore the effects of air resistance and assume no energy is lost during collision.



5.1 State the *principle of conservation of linear momentum* in words. (2)

5.2 Calculate the velocity of ball **A** just before it collides with ball **B**. (4)

5.3 Calculate the velocity of ball **B** immediately after the collision. (4)

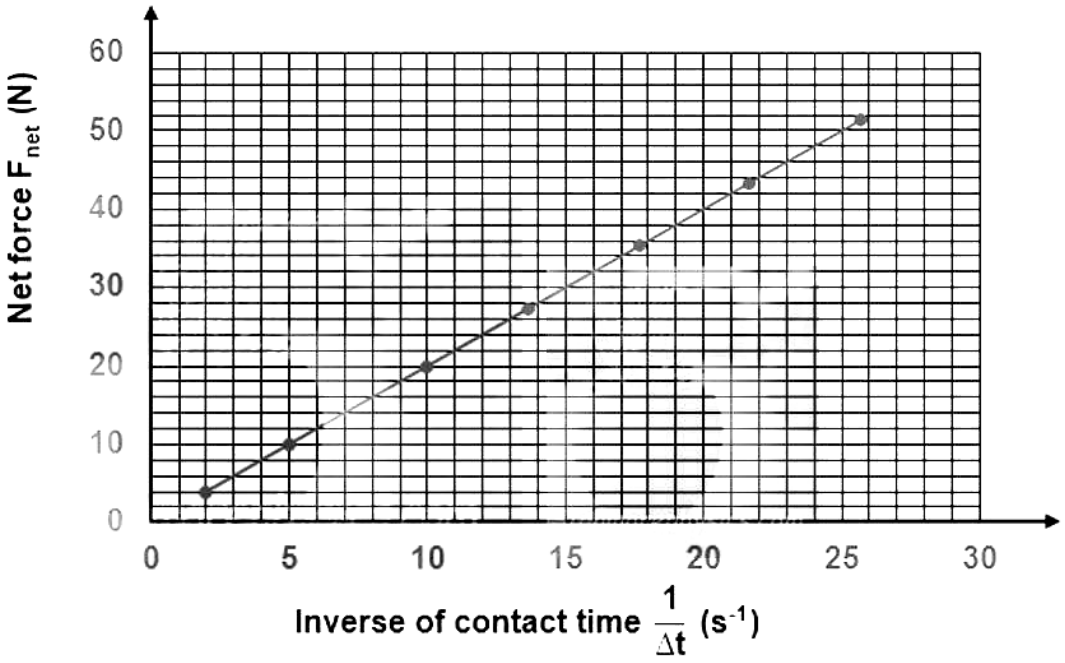
5.4 Is the collision between ball **A** and ball **B** ELASTIC of INELASTIC? (1)
[11]

QUESTION 6 (Start on a new page.)

The learners investigate the relationship between the net average force exerted on a tennis ball during a bounce and the inverse of the contact time.

A tennis ball of mass 0,06 kg is dropped from rest from a height of 6 m above the floor. The learners records the contact times and plots a graph of the net force versus the inverse of contact time, as shown in the graph below.

Ignore the effects of air friction.



6.1 Define the term *impulse*. (2)

6.2 Calculate the impulse of the tennis ball. (3)

The tennis ball strikes the floor at a velocity of 10,84 $m \cdot s^{-1}$ and it remains in contact with the floor for 0,1 s.

6.3 Calculate the bouncing velocity of the tennis ball. (3)

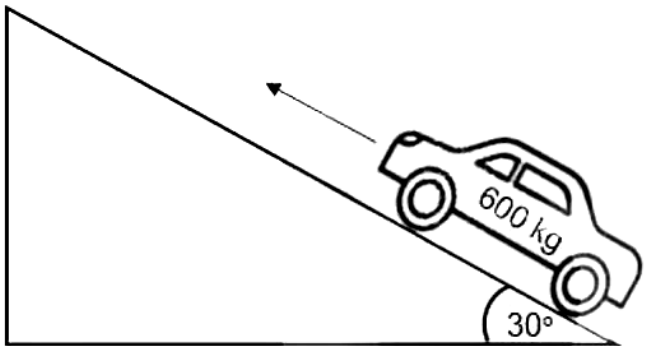
A rubber mat is placed on the floor, and the same tennis ball is dropped from the same height.

6.4 How will the net force on the tennis ball by the floor be affected? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

6.5 Explain the answer to QUESTION 6.4. (2)
[10]

QUESTION 7 (Start on a new page.)

A car of mass 600 kg drives at a CONSTANT VELOCITY up a rough incline plane of 30° as shown in the diagram below.



7.1 What is the net work done on the car as it drives up the inclined plane. (1)

7.2 Draw a labelled free-body diagram showing all the forces acting on the car as it drives up the inclined plane. (4)

7.3 The car now accelerates up the slope. The car's engine exerts a force of 600 N and the coefficient of kinetic friction between the wheels of the car and the surface is 0,23.

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

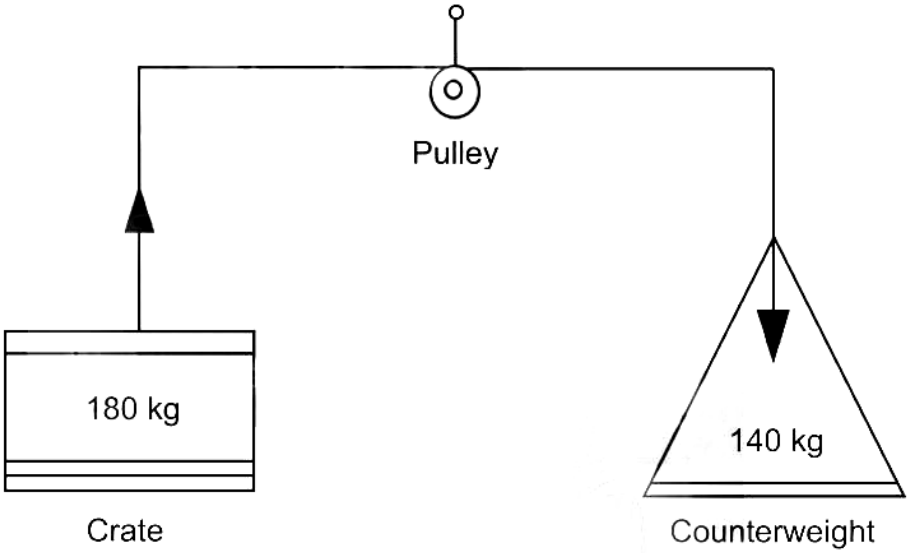
7.3.2 Using ENERGY PRINCIPLE ONLY, calculate the magnitude of the velocity of the car after moving 30 m up the incline. (7)
[14]

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QUESTION 8 (Start on a new page.)

A warehouse uses a motor-driven pulley system to lift a 180 kg crate vertically upward at a CONSTANT VELOCITY. A 140 kg counterweight hangs on the other side of a light pulley. Ignore the effects of friction.

The crate rises a vertical height of 4,5 m in 3 s.



8.1 Define the term *power*. (2)

8.2 Calculate the work done by:

8.2.1 the gravitational force on the crate (3)

8.2.2 the counterweight on the crate (2)

8.3 Calculate the average power delivered by the motor. (6)
[13]

QUESTION 9 (Start on a new page.)

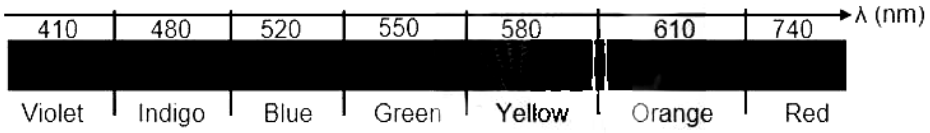
A model aeroplane with a siren that produces sound waves with a wavelength of 0,2 m flies horizontally over a group of spectators at a speed of 10 km.h^{-1}. Take the speed of sound in air as 330 m.s^{-1}.

9.1 Calculate the frequency of the sound waves that the siren of an aeroplane produces. (3)

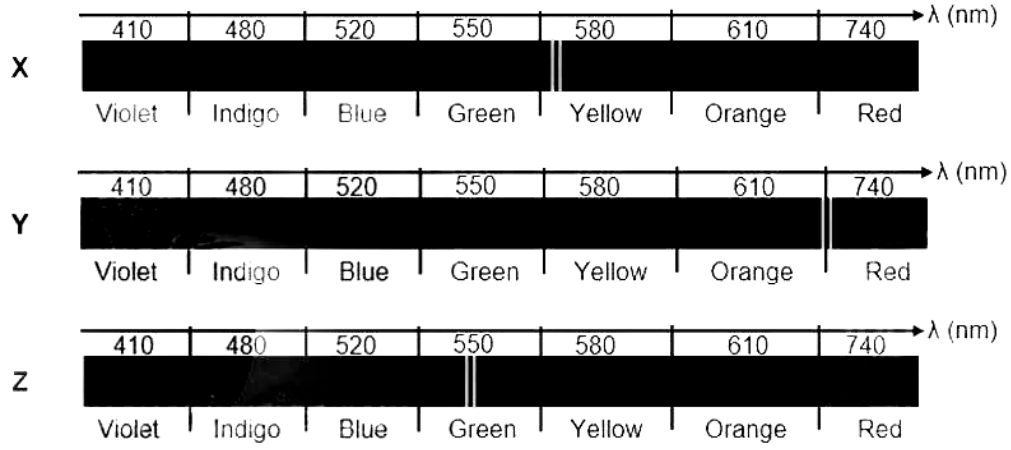
9.2 Determine by what factor the emitted frequency is increased or decreased to obtain the frequency observed by the spectators when the aeroplane flies towards them (round off to 4 decimals). (4)

9.3 Calculate the frequency of the sound heard by the spectators when the aeroplane flies away from them. (4)

9.4 Consider the following spectrum of glowing sodium (Na) gas which is used in street lamps. Two bright lines, orange in colour, are observed.



Consider the following spectra **X**, **Y** and **Z** from the light of nearby stars, observed from Earth:



9.4.1 Which one of the spectra **X**, **Y**, or **Z**, shows a red shift? (1)

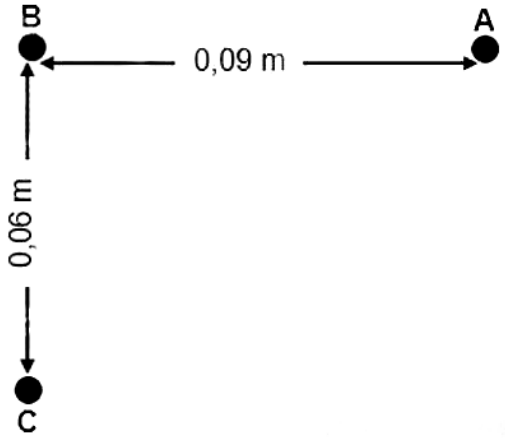
9.4.2 In which direction relative to the Earth are stars moving? (2)

9.4.3 What can be deduced from an observed red shift? (2)
[16]

QUESTION 10 (Start on a new page.)

Three CHARGED objects, **A**, **B** and **C** are placed at a right angle to each other in a 2D plane as shown in the diagram below.

Object **A** (-45 µC) is 0,09 m from object **B** (+20 µC), while object **C** (+30 µC) is 0,06 m from object **B**.

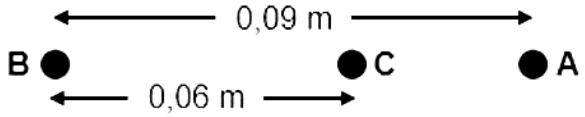


10.1 State Coulomb's law in words. (2)

10.2 Calculate the electrostatic force exerted on B due to the presence of object **A**. (4)

10.3 The magnitude of the electrostatic force exerted on **B** due to the presence of **C** is 1,5 x 10^3 N. Calculate the magnitude of the net electrostatic force exerted on **B** due to the presence of **A** and **C**. (3)

10.4 Object **C** is now placed between **A** and **B** at a distance 0,06 m from **B**.



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

10.4.2 Calculate the net electric field at **C** if the magnitude of the electric field that **C** experiences due to **B**, is equal to 5 x 10^7 N.C^{-1}. (6)
[17]

TOTAL: 150

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DATA FOR PHYSICAL; SCIENCES GRADE 12
PAPER 1 (PHYSICS

TABEL 1: FISIESE KONSTANTES

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Spoed of light in a vacuum	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant	h	6,63 x 10^{-34} $J \cdot s$
Coulomb's constant	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Charge on electron	e	1,6 x 10^{-19} C
Electron mass	m_e	9,11 x 10^{-31} kg
Radius of the Earth	R_E	6,38 x 10^6 m
Mass of the Earth	M_E	5,98 x 10^{24} kg

TABLE 2: FORMULAE

MOTION

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

FORCE

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

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WORK, ENERGY AND POWER

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

WAVES, SOUND AND LIGHT

$v = f\lambda$	$T = \frac{1}{f}$
$f_L = \frac{v \pm v_L}{v \pm v_b} f_b$	$E = hf$ of $E = \frac{hc}{\lambda}$
$E = W_0 + E_{k(maks)}$ of $E = W_0 + K_{maks}$ waar $E = hf$ en $W_0 = hf_0$ en $E_{k(maks)} = \frac{1}{2}mv^2_{maks}$ of $K = mv^2_{maks}$	

ELECTROSTATICS

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

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