education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES P1

(PHYSICS)

SEPTEMBER 2018

COMMON TEST

TIME: 3 hours

MARKS: 150

This question paper consists of 18 pages, two data sheets and a special answer sheet.

INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK.**
2. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.
3. Questions 5.2.1 and 9.3 must be answered in the special answer sheet provided. Write your name on this sheet and submit it together with your answer book.
4. Start EACH question on a NEW page in the ANSWER BOOK.
5. Number the answers correctly according to the numbering system used in this question paper.
6. Leave ONE line between two subsections, for example between QUESTION 2.1 and QUESTION 2.2.
7. You may use a non-programmable calculator.
8. You may use appropriate mathematical instruments.
9. You are advised to use the attached DATA SHEET.
10. Show ALL formulae and substitutions in ALL calculations.
11. Round off your final numerical answers to a minimum of TWO decimal places.
12. Give brief motivations, discussions, et cetera where required.

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, for example 1.11 D.

1.1 Which of the following pairs are both vector quantities?

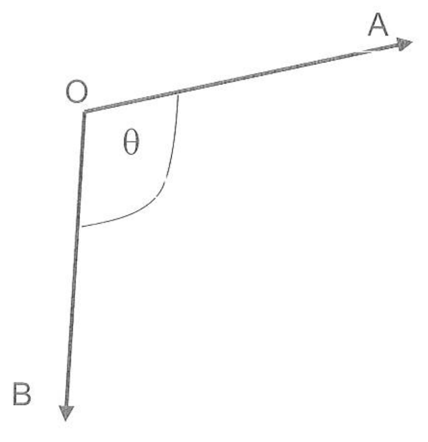
A Displacement and energy

B Speed and force

C work and mass

D Weight and acceleration (2)

1.2 Two forces A and B each of magnitude 15 N act on the same point O. If the resultant of these forces is 15 N, what is the magnitude of the angle θ between them?



A 60^{o}

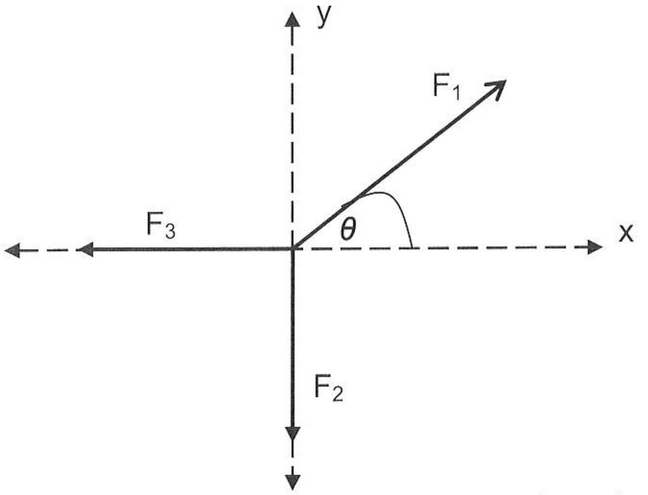
B 120^{o}

C 90^{o}

D 30^{o}

(2)

1.3 Three forces with magnitudes F_1,F_2 and F_3 act on the same point P in the same plane. The system is in equilibrium.



The resultant of the Y components of the forces force is given by :

A $F_1\sin\theta + F_2 + F_3$
B $F_3 - F_1\cos\theta$
C $F_2 + F_1\cos\theta$
D $F_1\sin\theta - F_2$

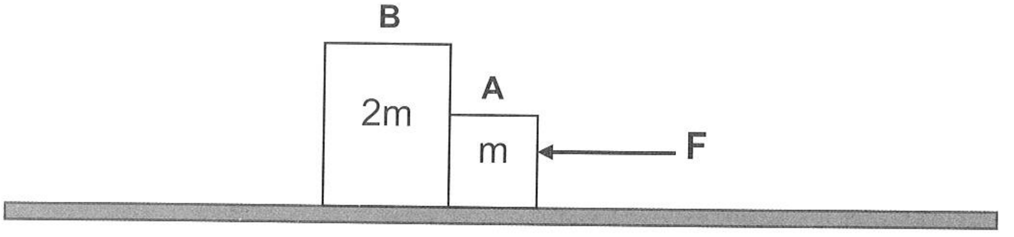
(2)

1.4 In which of the following cases is the resultant force acting on an object equal to zero?

A An object is moving with constant acceleration.
B When the only force acting on the object is the gravitational force.
C An object undergoes equal displacements every second.
D An object is moving with increasing acceleration.

(2)

1.5 Two blocks, A and B, with masses m and 2m respectively, are in contact with each other. The blocks are accelerated by a horizontal force F along a frictionless, horizontal surface.



What is the magnitude of the force that **B** exerts on **A**?

A 2F

B F

C 2F/3

D F/3 (2)

1.6 Which of the examples stated below best describes *Weightlessness*?

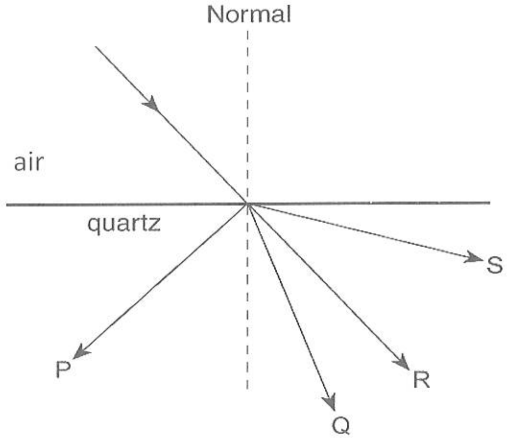
A An object accelerates downwards towards the Earth at an acceleration of 9,8 $m{\cdot}s^{-2}$.

B An object moving at a constant velocity upwards away from the ground.

C An object moving at constant velocity downwards towards the ground.

D An object that is accelerated upwards away from the ground by a constant applied force. (2)

1.7 The diagram below represents a ray of monochromatic light passing from air into quartz.



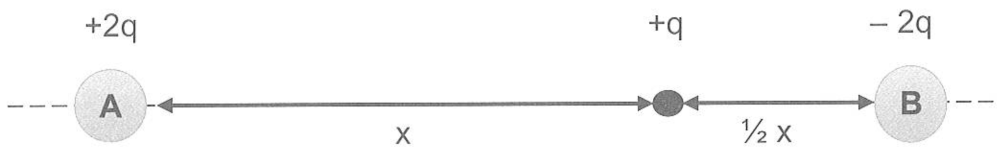
Which path will the ray follow in the quartz?

A P
B Q
C R
D S (2)

1.8 The field generated around a current carrying conductor is

A a magnetic field
B an electric field
C parallel to the conductor
D greater further away from the conductor. (2)

1.9 In the diagram below, a unit positive charge q is located between two charged spheres, A and B. Sphere A has a charge of +2q and is located x meter from charge q. Sphere B a charge of –2q and is located ½ x meter from charge q.



If the magnitude of the force on charge q due to sphere A is F, what is the magnitude of the force on charge q due to sphere B?

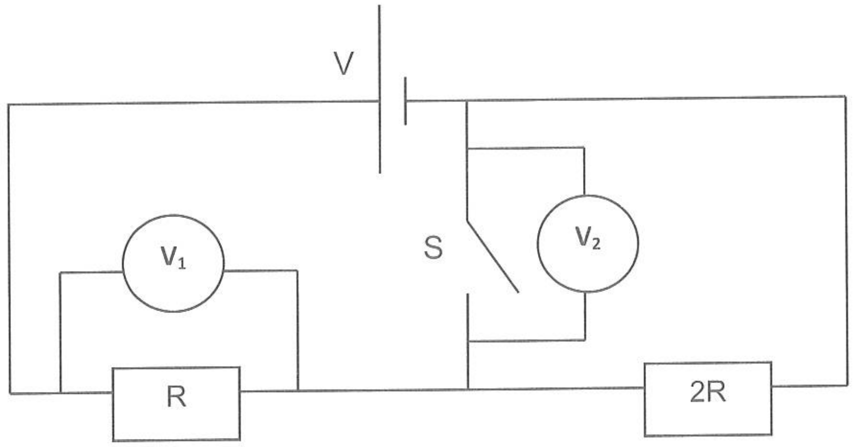
A ¼ F

B 2 F

C ½ F

D 4 F

1.10 Consider the circuit diagram below:



When switch S is closed, the readings on V_1 and V_2 (respectively) will change as follows:

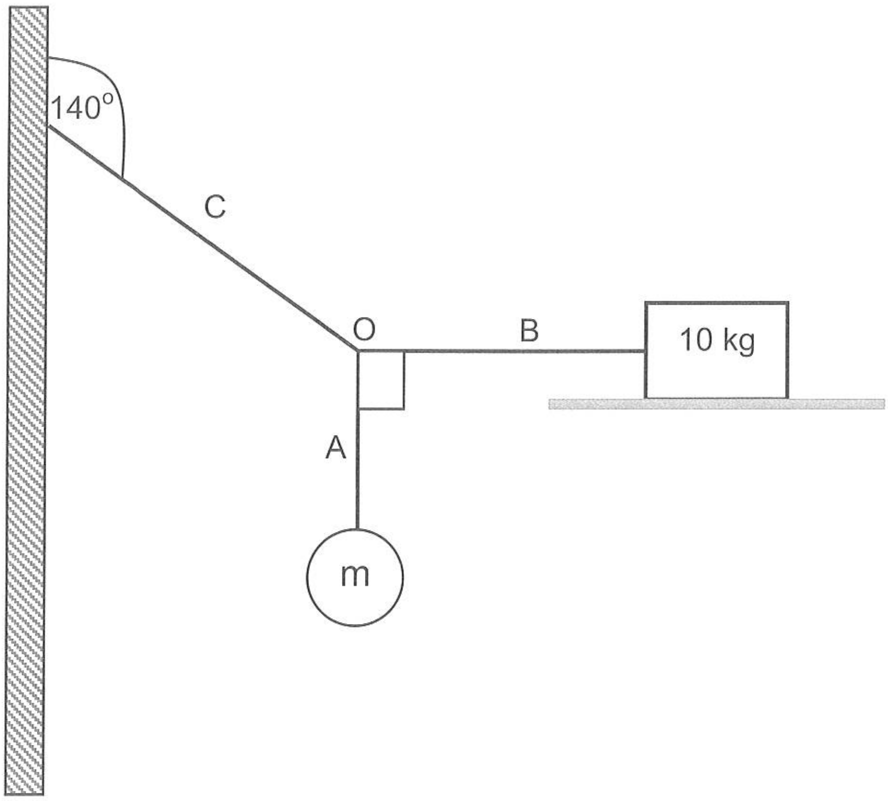
	V_1	V_2
A	decreases	increases
B	increases	decreases
C	decreases	decreases
D	increases	remains the same

(2)

[20]

QUESTION 2

In the system below the two masses labelled m and 10 kg are connected to each other by two light strings A and B at point O. Point O is kept stationary by attaching it to a wall using string C.
The coefficient of static friction between the 10 kg mass and its surface is 0,51.



2.1 Define static friction. (2)

2.2 Calculate the magnitude of the frictional force between the 10 kg mass and its surface. (3)

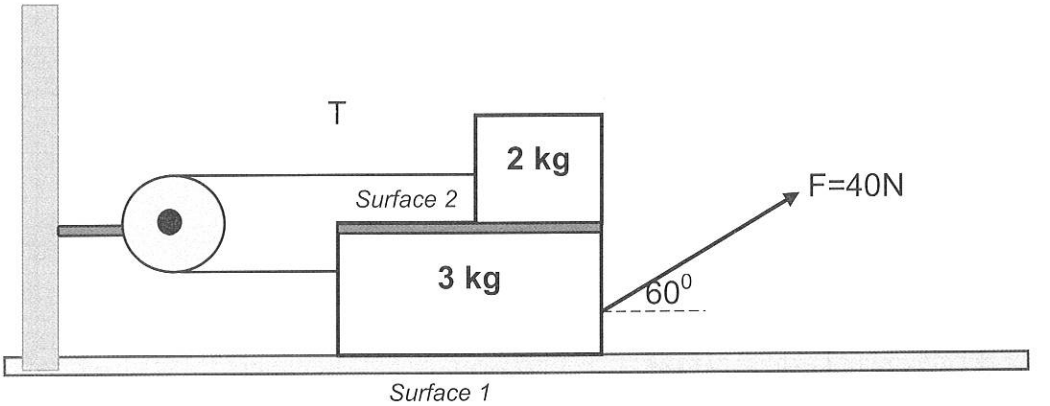
2.3 Determine the mass of m. (5)

2.4 Will the force in string A **increase**, **decrease** or **stay the same** if string B is detached from the 10 kg mass? (1)

[11]

QUESTION 3

3.1 A force of magnitude 40N is applied to a 3 kg block at an angle of 60^0 to the horizontal along a rough surface (surface1) as shown below. A second 2kg block is placed on the rough upper surface (surface 2) of the first block. The two blocks are joined by a string of negligible mass running through a frictionless pulley. The kinetic frictional force between the 3 kg block and surface 1 is 2 N whilst the kinetic frictional force between the 2kg block and surface 2 is 1,2 N. Let T be the tension in the strings connecting the two blocks as the 3kg block accelerates to the right.



3.1.1 Define Newtons Second law of motion. (2)

3.1.2 Draw a labelled free body diagram showing all the forces acting on the 3 kg block. (5)

3.1.3 Calculate the Tension(T) in the string (7)

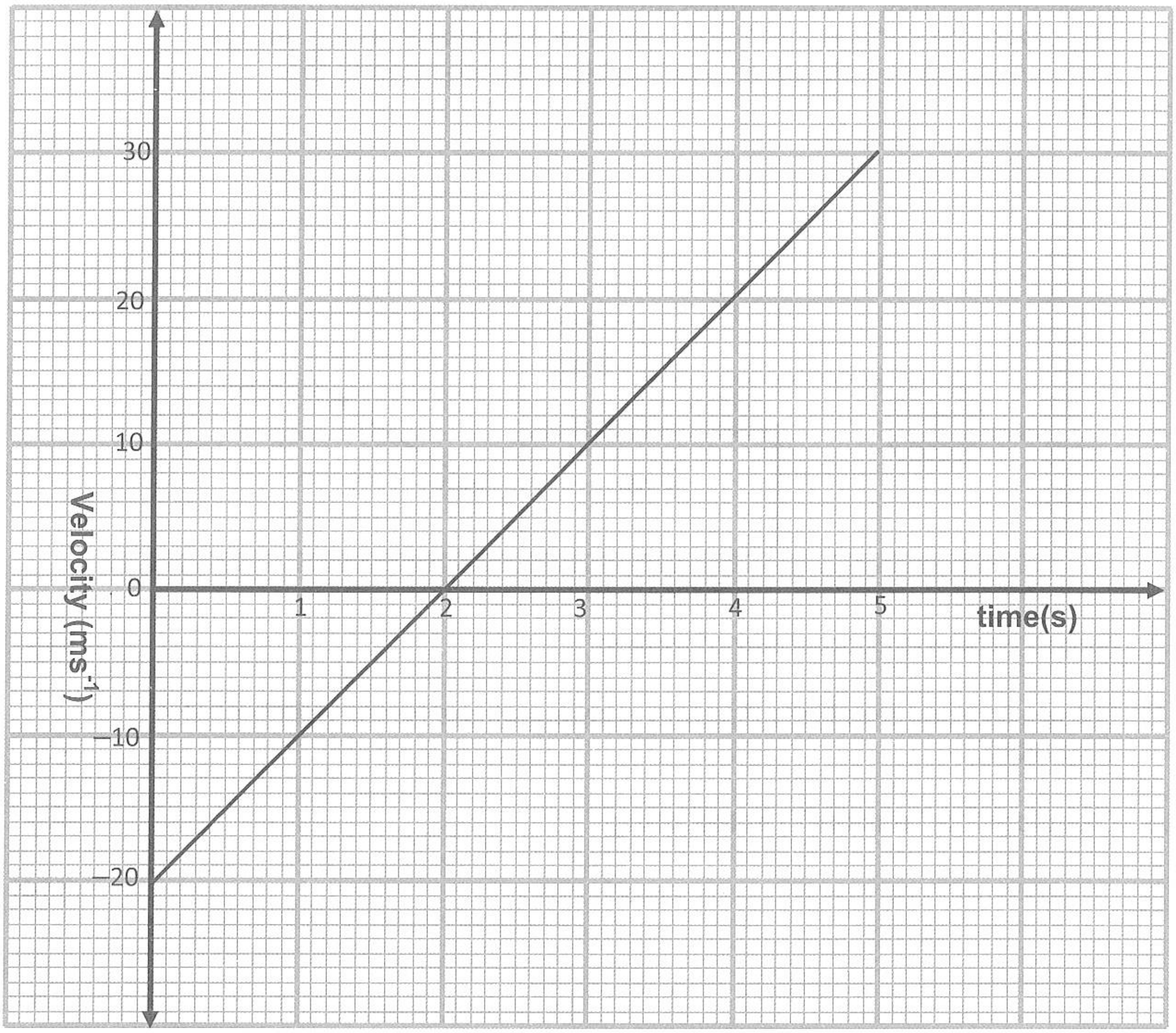
[14]

QUESTION 4

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

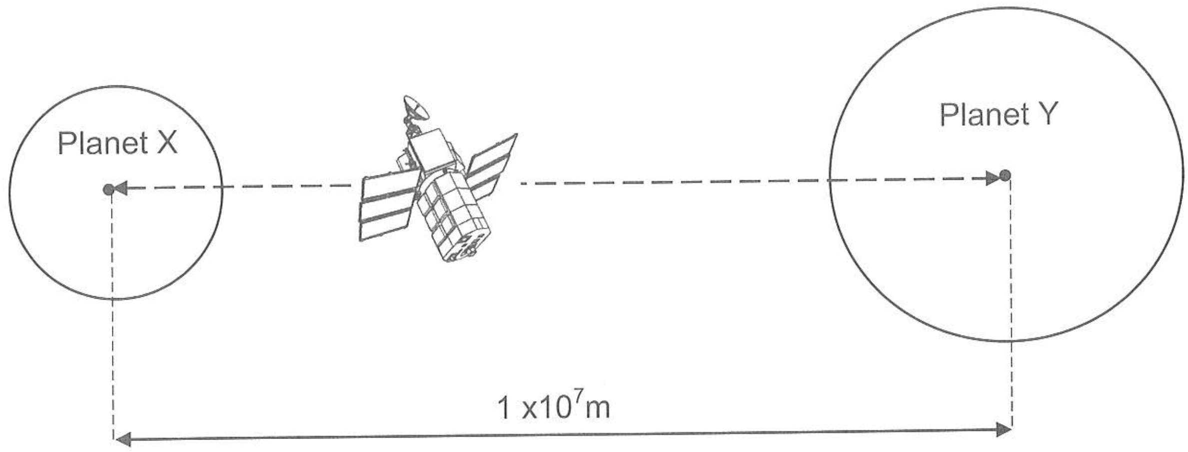
4.2 The velocity - time graph shown below describes the motion of an object of mass m thrown upwards and then falling downwards on Planet X for 5s. Assume that the only force acting on the object is the gravitational force of planet X.

Velocity(ms^{-1}) vs time(s)



The radius of planet X is $6,22 \times 10^5$ m. Using the graph above and relevant formulae, calculate the mass of planet X. (5)

4.3 A satellite is orbiting planet X. When the satellite is on the line joining the centres of planet X and planet Y, the net gravitational force acting on the satellite due to planet X and planet Y is zero.
The distance between the centres of planet X and planet Y is 1×10^7 m



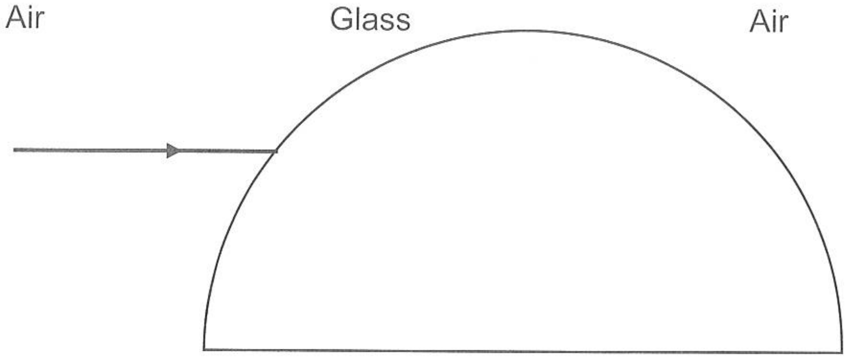
If the mass of planet Y is twice the mass of planet X, calculate the distance of the satellite from planet X. (4)

[11]

QUESTION 5

5.1 Define refraction of light. (2)

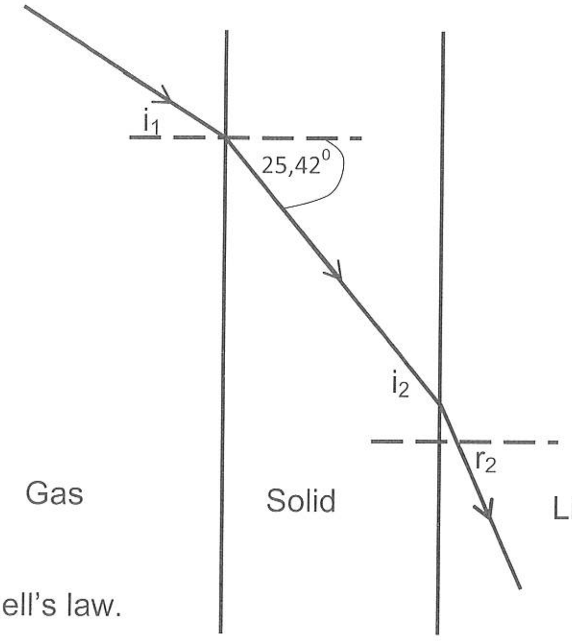
5.2 A ray of light is incident upon the surface of a semi-circular glass block as shown in the sketch below.



5.2.1 Using the diagram sheet provided, complete the diagram by showing the path taken by the light ray as it passes from air to glass and then to air. Label the angle of incidence, the refracted ray, the emergent ray and draw the normal at each surface. (4)

5.2.2 If the refractive index of glass is 1,50, calculate the speed of light through glass given that the speed of light in air is 3×10^8 ms^{-1}
Take the refractive index of air to be 1,00. (3)

5.3 The drawing shows a ray of light travelling through a gas (n = 1.00), then through a solid (n = 1.55), and then into a liquid (n = 1.45).
The surfaces are parallel and the angle of refraction at the first surface is 25,42°.



5.3.1 State Snell's law. (2)

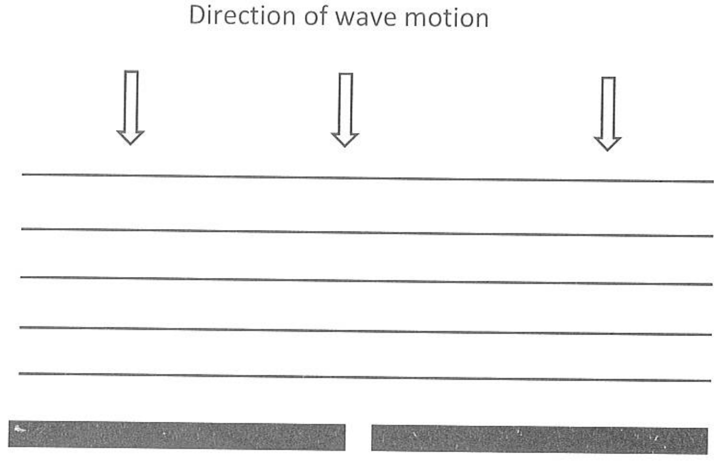
5.3.2 Calculate $\hat{r}_2$,the angle of refraction at the second surface. (4)

5.3.3 If the size of $\hat{i}_1$ is increased, will the size of angle $\hat{r}_2$ **increase**, **decrease** or **remain the same**? (2)

[17]

QUESTION 6

6.1 The sketch below shows a phenomenon that takes place when parallel wave fronts approach a narrow opening in a barrier.



6.1.1 State and define the above phenomenon. (3)

6.1.2 Sketch the wave pattern that occurs when the wave fronts pass through the opening in a barrier. (2)

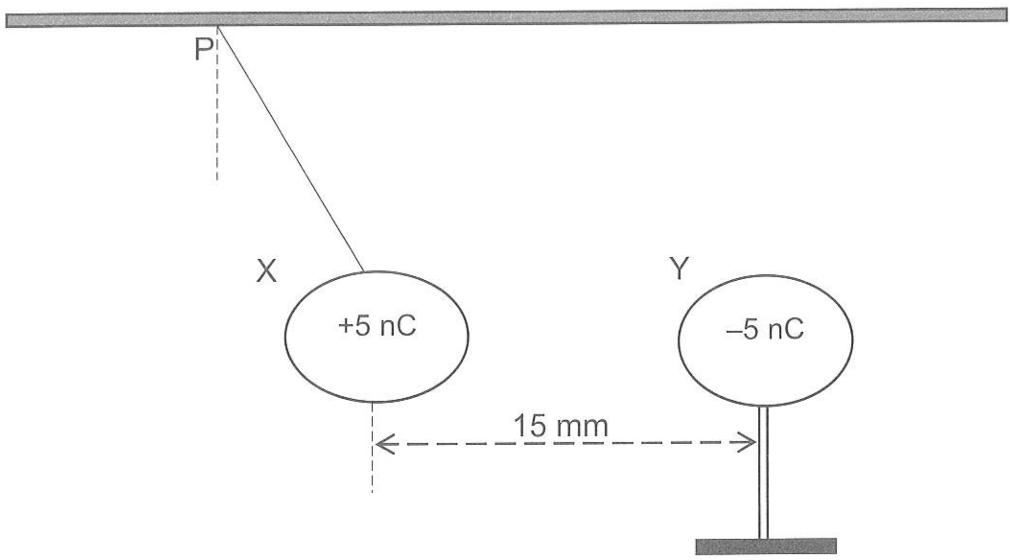
6.1.3 The wave pattern that forms is explained by Huygens principle. State this principle. (2)

6.2 When monochromatic blue light is passed through a narrow single slit, a pattern is observed on a screen. Describe the diffraction pattern which is observed on the screen. (3)

[10]

QUESTION 7

A small, conducting sphere, X, with a charge of +5 nC is suspended by an insulated inelastic thread of negligible mass, which is tied to point P. Another small conducting sphere, Y, on an insulated stand, with a charge of –3 nC, is brought closer to X until their centres are 15 mm apart on the same horizontal line.



7.1 Draw the resultant electric field pattern produced by spheres X and Y. (3)

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

7.3 Calculate the magnitude of the electrostatic force that sphere Y exerts on sphere X. (4)

7.4 Define Electric field at a point. (2)

7.5 Calculate the magnitude of the electric field 15mm away from sphere X (4)

Sphere Y is now moved closer and makes contact with sphere X and moved back to its original position, that is 15mm from X.

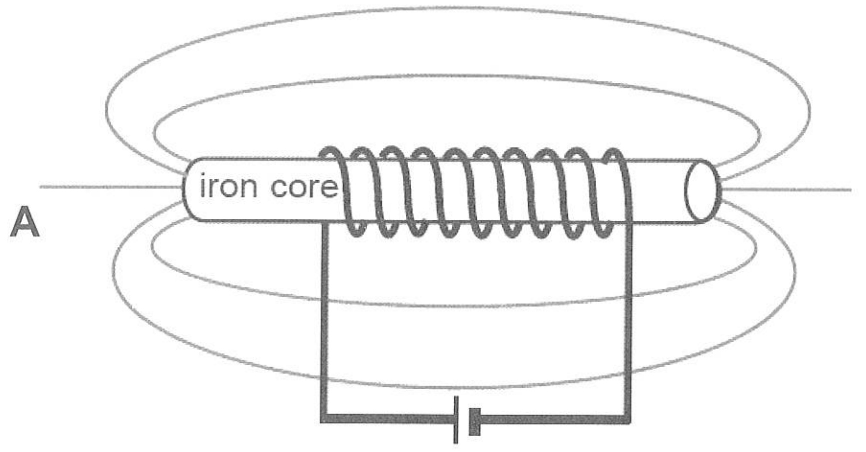
7.6 Will electrons be transferred from spheres X to Y or from spheres Y to X? Give a reason for your answer. (2)

7.7 Calculate the number of electrons transferred upon contact. (4)

[21]

QUESTION 8

8.1 The sketch below shows a current carrying solenoid that is wrapped around a soft iron core.

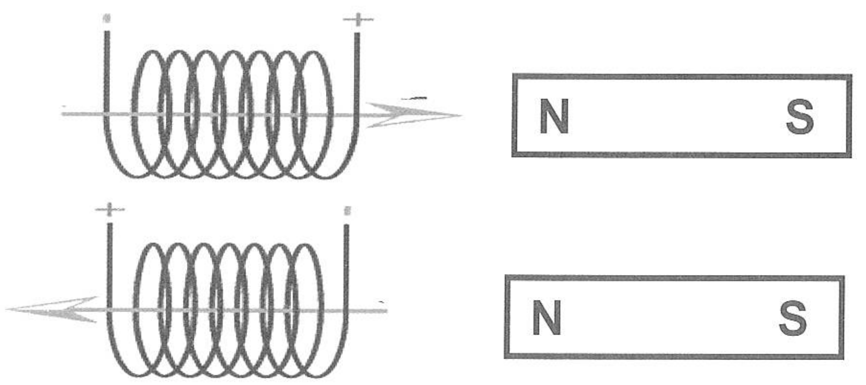


Does A represent the North pole or the South pole of the magnetic iron core?

8.1.1 Is the magnetic field direction outside the iron core from A to B or from B to A? (1)

8.1.2 A coil is moved into or out of a magnetic field of a bar magnet as shown below so that the rate of change of magnetic field, $\Delta B = 0{,}6\ T{\bullet}s^{-1}$ (1)

8.2



The area through which the field links with the coil is given by $A = 0{,}4\ m^2$.

8.2.1 State *Faraday's law of electromagnetic induction* in words. (2)

8.2.2 Calculate the magnitude of the average emf generated in the coil, if the coil has 8 turns. (4)

8.2.3 If the experiment is repeated with a new coil that has twice as many turns, what would the new emf be? (2)

[10]

QUESTION 9

Learners conduct an investigation to verify Ohm's law. They measure the current through a resistor for different potential differences across its ends, i.e. the potential difference was chosen as the independent variable.
The results obtained are tabulated below:

Potential Difference (V)	Current Strength (A)
21,4	0.80
35,8	1,20
56,0	1,90
72,04	2,30
98,04	3,20
124,04	4,13

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

9.2 ***The dependant variable in this investigation was the current.***

9.2.1 Name one quantity that was controlled in this investigation. (1)

9.2.2 State how the quantity in Q 9.2.1 was kept constant (1)

9.3 Using the information in the table and the graph sheet provided, draw a graph of Current versus Potential difference. (5)

9.4 Calculate the gradient of the graph. (4)

9.5 What quantity does the gradient of the graph represent? (1)

9.6 Hence determine the resistance of the resistor. (2)

[16]

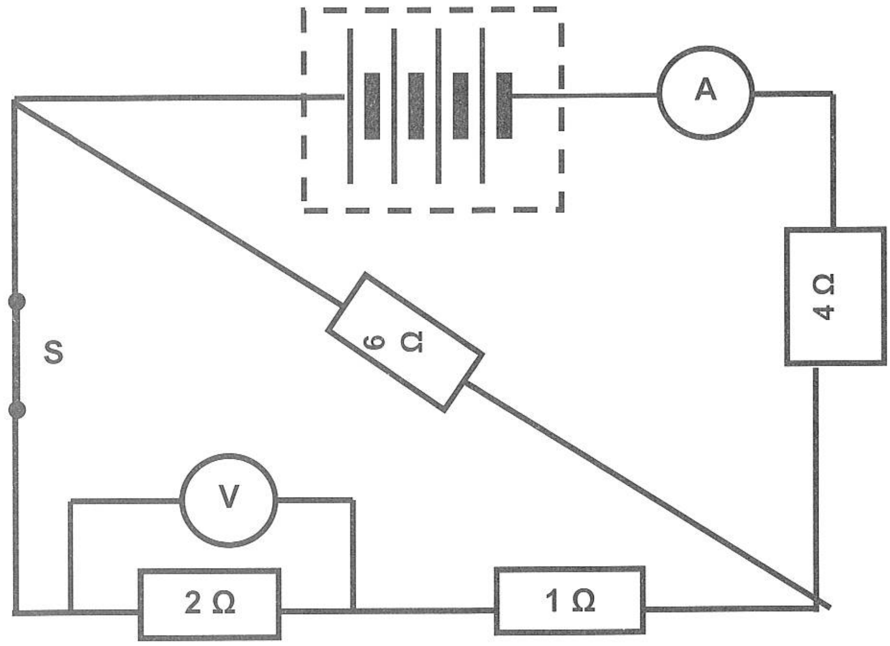
QUESTION 10

10.1 You are given four identical resistors, each of magnitude 'R' and a battery of emf 'V' volts.

10.1.1 Sketch an appropriate circuit diagram, using all the above components, to show how you would connect them to obtain a total resistance of R in the circuit. (2)

10.1.2 Use relevant calculations to show that the total resistance in your circuit in Q10.1.1 is equal to R. (2)

10.2 The circuit diagram below shows a battery of unknown EMF with negligible internal resistance, connected as shown below.



The reading on the voltmeter is 4 V.

Calculate:

10.2.1 the effective resistance in the circuit. (3)

10.2.2 the current flowing through the 1 Ω resistor. (3)

10.2.3 the reading on the ammeter. (4)

10.2.4 the EMF of the battery (3)

10.3 ***The switch S is now opened.***

10.3.1 How will the energy dissipated by the 4 Ω resistor change if the time it is in operation remains constant? State whether it will **increase**, **decrease** or **remain the same**. (1)

10.3.2 Briefly explain your answer using relevant formulae . (2)
[20]

TOTAL : 150

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	G	$9,8\ m\cdot s^{-2}$
Gravitational constant	G	$6,67 \times 10^{-11}\ N\cdot m^2\cdot kg^{-2}$
Coulomb's constant	K	$9,0 \times 10^9\ N\cdot m^2\cdot C^{-2}$
Speed of light in a vacuum	C	$3,0 \times 10^8\ m\cdot s^{-1}$
Charge on electron	e	$-1,6 \times 10^{-19}$ C
Electron mass	m_e	$9,11 \times 10^{-31}$ kg
Radius of earth	R_E	$6,38 \times 10^6$ m
Mass of earth	M_E	$5,98 \times 10^{24}$ kg

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$f_{s(max)} = \mu_s N$
$f_k = \mu_k N$	$g = \frac{GM}{R^2}$

WAVES, SOUND AND LIGHT

$v = f\lambda$	$T = \frac{1}{f}$
$n_i \sin\theta_i = n_r \sin\theta_r$	$n = \frac{c}{v}$

ELECTROSTATICS

$F=\frac{kQ_1Q_2}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$E=\frac{F}{q}$
$E=\frac{kQ}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$V=\frac{W}{Q}$

ELECTROMAGNETISM

$\varepsilon=-N\frac{\Delta\Phi}{\Delta t}$	$\Phi=BA\cos\theta$

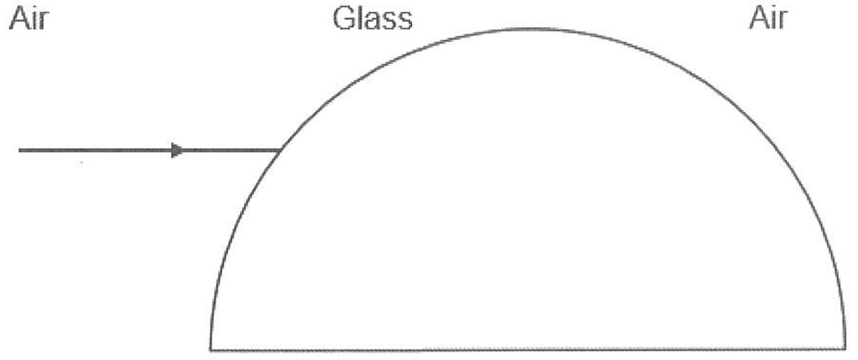
CURRENT ELECTRICITY

$I=\frac{Q}{\Delta t}$	$R=\frac{V}{I}$
$\frac{1}{R}=\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}+\ldots$	$R=r_1+r_2+r_3+\ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W=\frac{V^2\Delta t}{R}$	$P=\frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P=\frac{V^2}{R}$

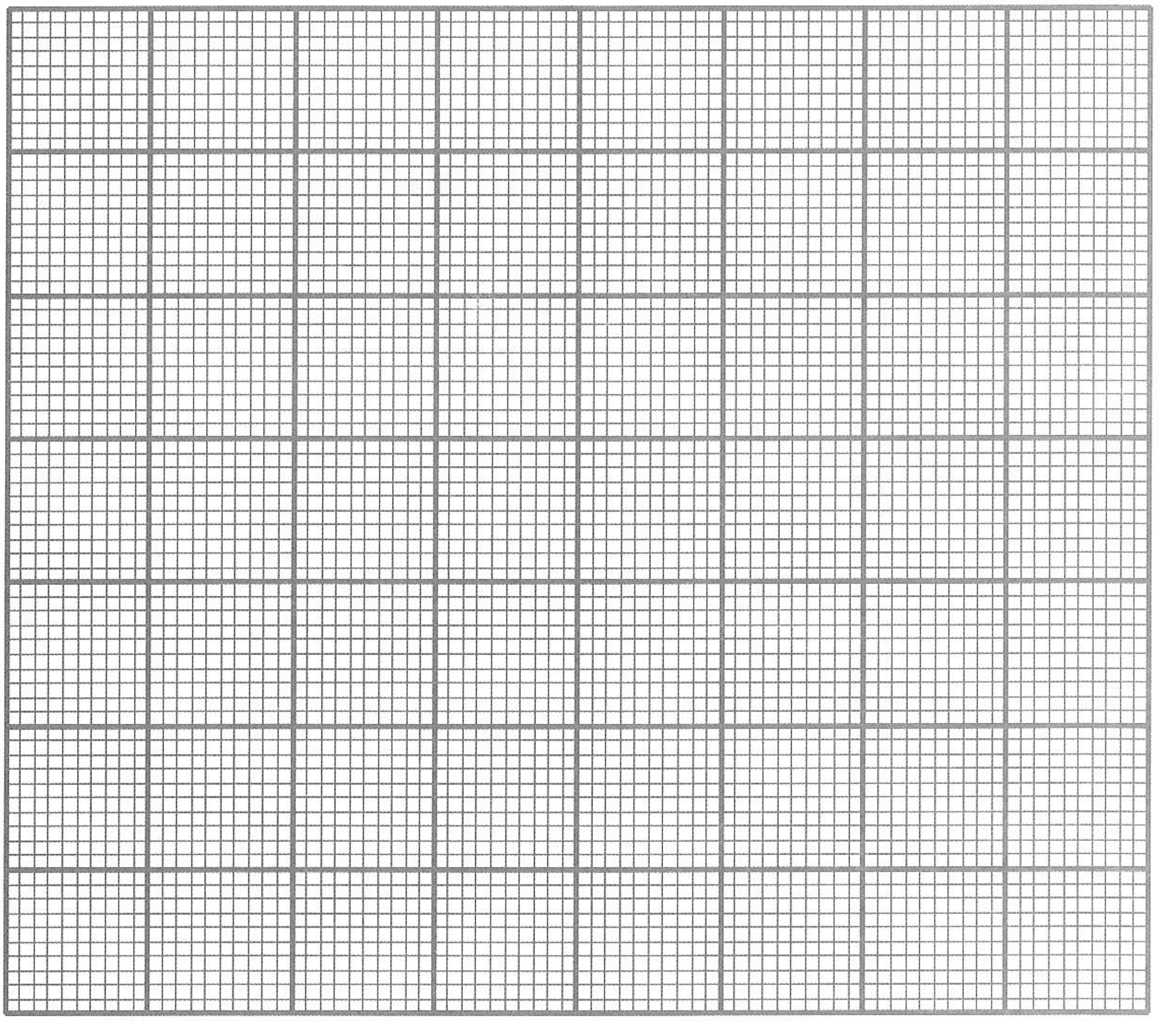
TEAR-OFF SHEET

NAME OF LEARNER :____

Question 5.2



Question 9.3



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PHYSICAL SCIENCES P1

MARKING GUIDELINE

COMMON TEST

SEPTEMBER 2018

NATIONAL SENIOR CERTIFICATE

GRADE 11

This marking guideline consists of 14 pages.

QUESTION ONE

1.1 D ✓✓

1.2 B ✓✓

1.3 D ✓✓

1.4 C ✓✓

1.5 C ✓✓

1.6 A ✓✓

1.7 B ✓✓

1.8 A ✓✓

1.9 D ✓✓

1.10 B ✓✓

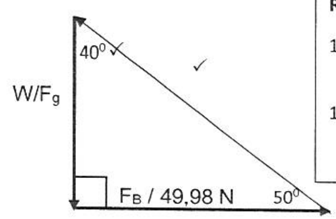
[20]

QUESTION TWO

2.1 Force that opposes the tendency of motion of a stationary object relative to a surface.✓✓ (2)

2.2 $F_S = \mu_s \cdot F_N$ ✓
$= 0{,}51 \cdot 10 \cdot 9{,}8$ ✓
$= 49{,}98$ N ✓ (3)

2.3 **Positive marking from question 2.1**

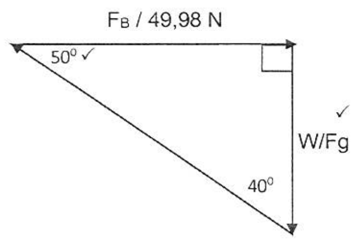


Rubric

1 mark- Correct vector drawing with labels

1 mark- any correct acute angle given

OR



$\tan 50^0 = \frac{W}{49,98}$ ✓

W = 59,564 N

W=m·g

59,564 = m·9,8✓

m = 6,08 kg✓

OR

$\tan 40^0 = \frac{49,98}{W}$ ✓

W = 59,564 N

W = m·g

59,564 = m·9,8✓ (5)

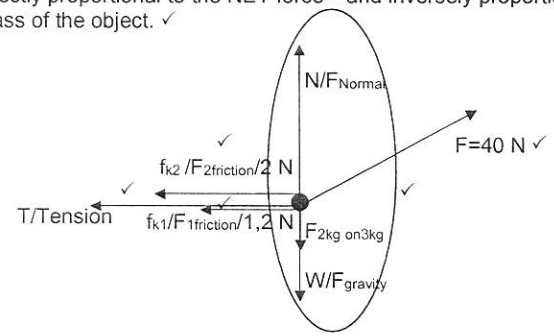
2.4 Stay the same✓ (1)

[11]

QUESTION THREE

3.1.1 If a non-zero NET force acts on an object, then the object accelerates in the direction of the NET force where the acceleration of the object is directly proportional to the NET force✓ and inversely proportional to the mass of the object. ✓ (2)

3.1.2



(5)

NB : 1 mark for all 3 vertical forces present.

3.1.3 Take the motion of the system to the right as being positive.

Consider the 3 kg block

$F_x = F \cdot \cos\theta$
$= 40 \cos 60^0$
$= 20$ N✓

$F_{NET} = m \cdot a$

$F_x + (-T) + (-f_{k1}) + (-f_{k2}) = 3 \cdot a$ } ✓ any one

$20 - T - 2 - 1,2 = 3 \cdot a$

$16,8 - T = 3 \cdot a$ ✓ ....(1)

Consider the 2 kg block

$F_{NET} = m \cdot a$

$f_{k2} + (-T) = 2(-a)$

$1,2 - T = -2a$

$T = 2a + 1,2$ ✓...........(2)

Substitute equation (2) in equation (1)

$16,8 - (2a + 1,2) = 3a$

$a = 3,12$

$T = 2(3,12)$ ✓ $+ 1,2$✓
$= 7,44$ N✓ (7)

[14]

QUESTION FOUR

4.1 Every body in the universe attracts every other body with a gravitational force that is directly proportional to the product of their masses✓ and inversely proportional to the square of the distance between their centres. ✓ (2)

4.2 gradient: $a = \frac{\Delta v}{\Delta t}$

$= \frac{30 - 0}{5 - 2}$ ✓ (Accept any pair of correct co-ordinates)

$= 10 m\cdot s^{-2}$

$a = \frac{G \cdot m_x}{r_x^2}$ ✓

10 ✓ $= \frac{6,67 \times 10^{-11} \cdot m_x}{(6,22 \times 10^5)^2}$ ✓

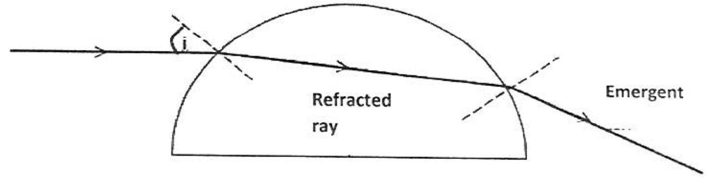
$m_x = 5,800 \times 10^{22}$ kg ✓ (5)

4.3	$F_{X \to Ms} + (-F_{Y \to Ms}) = 0$ / $F_{NET} = 0$ $F_{X \to Ms} = F_{Y \to Ms}$ $F = \frac{Gm_1m_2}{r^2}$ ✓ $\frac{G \cdot M_x \cdot M_s}{x^2} = \frac{G \cdot 2M_x \cdot M_s}{(1 \times 10^7 - x)^2}$ ✓ ✓ $x = 4,14 \times 10^6$ m ✓	(4)
		[11]

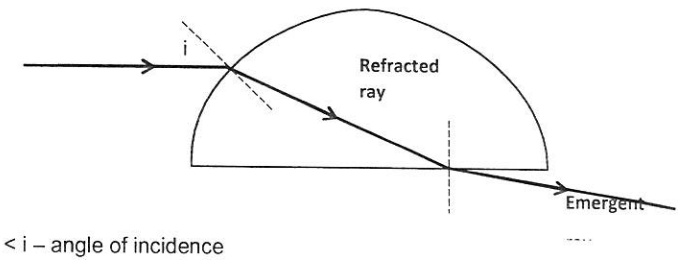
QUESTION FIVE

5.1 It is the change in direction/bending of light as it passes from one medium to another of different optical density.✓✓ (2 or 0). (2)

5.2.1



OR :



< i – angle of incidence

Marking Rubric : Ray diagram	
Criteria	Mark allocation
Both normal lines drawn correctly	1 mark
Angle of Incidence drawn and labelled	1 mark
Refracted ray correctly drawn(bent towards the normal)	1 mark
Emergent ray correctly drawn(bent away from the normal)	1 mark

(4)

NB : If Incident ray is drawn parallel to the Emergent ray – minus 1 mark

5.2.2 $n = \frac{c}{v}$ ✓

$1{,}50 = \frac{3\times10^8}{v}$ ✓

$v = 2\times10^8\ m\cdot s^{-1}$ ✓ (3)

5.3.1 The ratio of the sine of the angle of incidence in one medium to the sine of the angle of refraction in the other medium is a constant. ✓✓ (2 or 0) (2)

5.3.2 $\hat{i}_2 = 25{,}42^0$ ✓

$n_1 \sin\theta_1 = n_2 \sin\theta_2$ ✓

$1{,}55 \cdot \sin 25{,}42 = 1{,}45 \sin \theta_2$ ✓

$\Theta_2 = \hat{r}_2 = 27{,}31^0$ ✓ (4)

5.3.2 Increases ✓✓ (2)

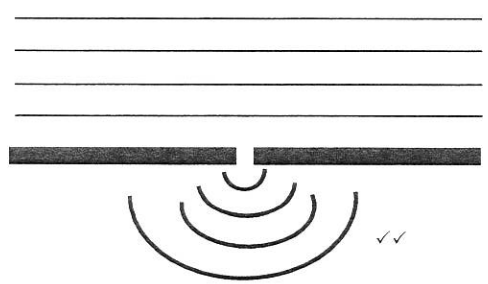
[17]

QUESTION SIX

6.1.1 Single slit <u>diffraction</u>.✓

It is the ability of a wave to spread out in wave fronts as they pass through a small aperture or around a sharp edge✓✓ (2 or 0 marks) (3)

6.1.2



✓✓ (2)

If shape is asymmetrical, minus 1 mark.

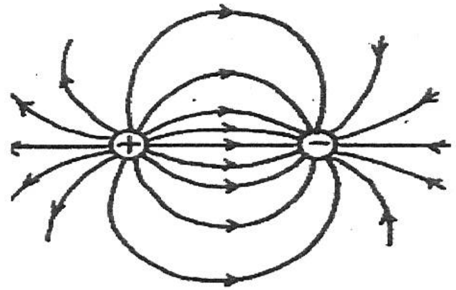
6.1.3 According to Huygens' principle <u>each point on a wave front forms secondary wavelets</u>✓ that <u>spreads out in all directions</u>✓ forming the above pattern. (2)

6.2 A broad central blue band✓ is observed flanked on either side by alternating <u>narrower</u>✓ dark and blue bands. ✓ (3)

[10]

QUESTION SEVEN

7.1



Marking Rubric : Electric field pattern	
Criteria	Mark allocation
Correct direction of field lines	1 mark
Correct shape of the field pattern	1 mark
Field lines do not touch, evenly spaced, and perpendicular to surface and touches the surface	1 mark

(3)

7.2 The magnitude of the electrostatic force exerted by two point charges on each other is directly proportional to the product of the magnitudes of the charges✓ and inversely proportional to the square of the distance between them.✓ (2)

7.3 $F = \frac{k\,Q_1Q_2}{r^2}$ ✓

$= \frac{9\times10^9 \cdot 5\times10^{-9} \cdot 5\times10^{-9}}{(15\times10^{-3})^2}$ ✓ ✓

$= 1{,}00 \times 10^{-3}$ N✓ (4)

7.4 The electric field at a point is the electrostatic force experienced per unit (positive) charge placed at that point.✓✓ (2 or 0) (2)

7.5 $E = \frac{k \cdot Q}{r^2}$ ✓

$= \frac{9\times10^9 \cdot 5\times10^{-9}}{(15\times10^{-3})^2}$ ✓ ✓

$= 2{,}00 \times 10^5$ N·C^{-1} ✓

OR

Positive marking from Q7.3

$E = \frac{F}{Q}$ ✓

$= 1{,}00\times10^{-3}$ ✓ (4)

7.6 Y to X. ✓Y has an excess of negative charge.✓ (2)

7.7 $Q_{After\ contact} = \frac{Q_1 + Q_2}{2}$

$= \frac{(+5) + (-5)}{2}$ ✓

$= 0$

$\Delta Q = Q_f - Q_i$
$= 0 - (-5)$
$= 5$nC / 5×10^{-9}C ✓

OR

$\Delta Q = Q_f - Q_i$
$= 0 - (+5)$
$= -5$nC / -5×10^{-9}C✓

$n_e = \frac{5\times10^{-9}}{1{,}6\times10^{-19}}$ ✓

$= 3{,}125 \times 10^{10}$ electrons✓ (4)

[21]

QUESTION EIGHT

8.1.1 South pole ✓ (1)

8.1.2 B to A (1)

8.2.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor.✓✓ (2 or 0) (2)

8.2.2 $\varepsilon = \frac{-N\Delta\phi}{\Delta t}$ ✓

$= \frac{-N \cdot \Delta B \cdot A \cdot \cos\theta}{\Delta t}$

$= -8 \cdot 0{,}6 \cdot 0{,}4$✓$\cdot \cos 0^0$✓

$= -1{,}92$ V ✓

OR

$\varepsilon = \frac{-N\Delta\phi}{\Delta t}$ ✓

$= \frac{-N \cdot \Delta B \cdot A \cdot \cos\theta}{\Delta t}$

$= -8 \cdot 0{,}6 \cdot 0{,}4$✓$\cdot \cos 180^0$✓ (4)

8.2.3 3,84 V / The emf will Double ✓✓ (2)

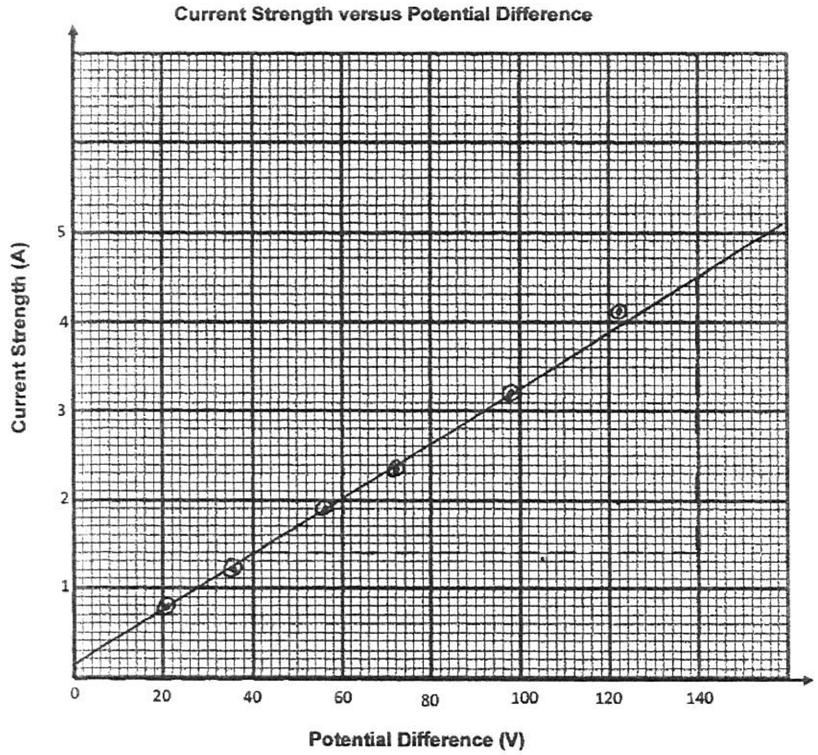
QUESTION NINE

9.1 The potential difference across a conductor is directly proportional to the current in the conductor✓ at constant temperature✓ (2)

9.2.1 Resistance / temperature of the resistor✓ (1)

9.2.2 Do not keep the circuit on for long periods of time.✓ (1)

9.3



Marking Rubric : Graph	
Criteria	Mark allocation
• Suitable scale used on x and y axes	1 mark
• X and Y axes correctly labelled with correct units	1 mark
• Correct plotting of points	2 marks
• Best fit curve drawn joining points	1 mark

9.4 Gradient(1/R) $= \frac{\Delta I}{\Delta V}$ ✓

$= \frac{4,5 - 1,4}{140 - 40}$ ✓ ✓

$= 0,031\ \Omega^{-1}$ ✓

- Accept any suitable set of co-ordinates that is taken from the graph.
- Acceptable range (0,020 – 0.040) (4)

9.5 Inverse of resistance✓/ $\frac{1}{R}$ (1)

9.6 **Positive marking from Q 9.4**

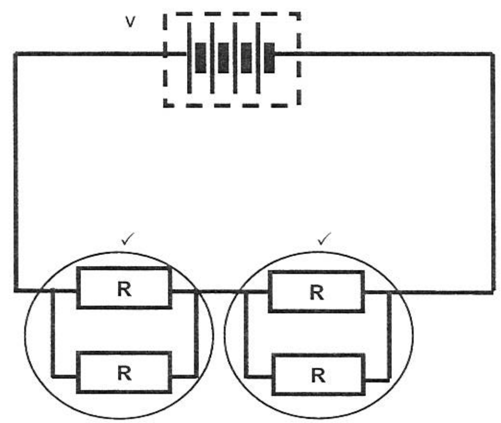
$\frac{1}{R} = 0,031$ ✓

R = 32,26 Ω✓ (2)

[16]

QUESTION TEN

10.1.1



(2)

Negative marking from Q10.1.1

10.1.2 $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{R_P} = \frac{1}{R} + \frac{1}{R}$ ✓

$R_P = ½ R$ (2)

$R_{TOTAL} = ½ R + ½ R$ ✓

$= R$

10.2.1 $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{6} + \frac{1}{3}$ ✓

$R_P = 2\ \Omega$ ✓

$R_{TOTAL} = R_P + R_S$

$= 2 + 4$

$= 6\ \Omega$ ✓ (3)

10.2.2 $I_{1\Omega} = I_{2\Omega}$

$= \frac{V}{R}$ ✓

$= \frac{4}{2}$ ✓

$= 2$ A ✓ (3)

10.2.3 **Positive marking from Q10.2.2**

OPTION 1

$V_{6\Omega} = (2+1)2 = 6$ V ✓

$I_{6\Omega} = \frac{V}{R}$

$= \frac{6}{6}$ ✓

$= 1$ A

$I_{TOTAL} = I_{3\Omega} + I_{6\Omega}$

$= 2 + 1$ ✓

$= 3$ A ✓ (4)

OPTION 2

$I_{6\Omega} : I_{2\Omega} = 3 : 6$

$I_{6\Omega} = \frac{3}{6} \cdot I_2$ ✓

$= \frac{3}{6} \cdot \frac{2}{1}$ ✓

$= 1$ A

10.2.4 **Positive marking from Q10.2.3**

$V = I \times R$ ✓

$= 3 \times 6$ ✓

$= 18$ V ✓

OR

$Emf = V_p + V_{4\Omega}$ ✓

$= 6 + (3)(4)$ ✓

$= 18$ V ✓ (3)

10.3.1 Decreases ✓ (1)

10.3.2 When switch S is opened, the total resistance in the circuit increases and the current strength decreases. ✓

$W = I^2 \cdot R \cdot \Delta t$

Since R and Δt remains constant ,

$W \propto I^2$, whereby I_{total} decreases ✓

∴ W decreases.

Hence the energy dissipated by the 4 Ω resistor decreases

OR

When switch S is opened, the total resistance in the circuit increases and the potential difference across the 4Ω resistor decreases (from 4/6·18 to 4/10·18) . ✓

$W = (V^2/R) \cdot \Delta t$

Since R and Δt remains constant ,

$W \propto V^2$, whereby V decreases ✓

∴ W decreases.

Hence the energy dissipated by the 4 Ω resistor decreases (2)

[20]

TOTAL : 150