HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE
GRADE 11
PAPER 1 memo - Physics

NOVEMBER 2021
TIME: 3 HRS

Total: 150

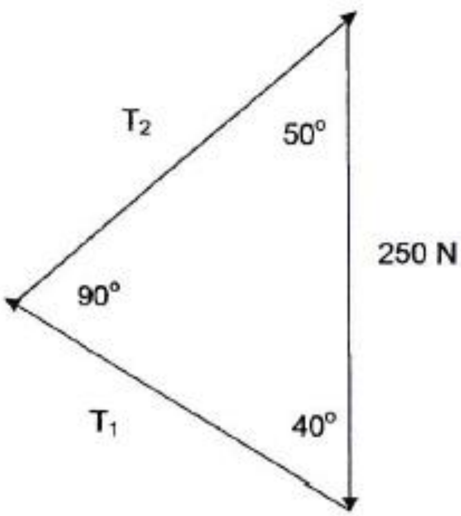
Question 1

1.1 B
1.2 D
1.3 C
1.4 A
1.5 C

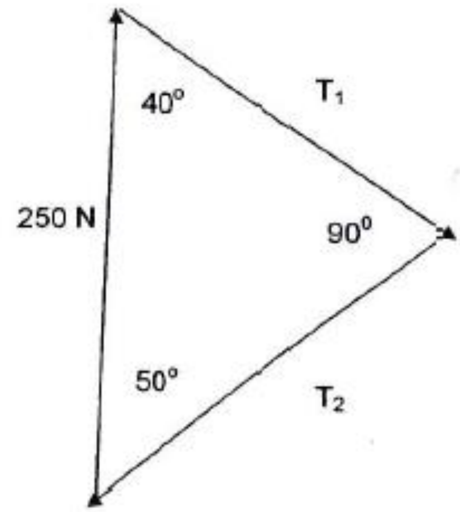
Question 2

2.1 Equilibrium means that all the forces on the system have a net force of zero. **OR** are balanced✓✓ (2)

2.2



Or



Criteria for marking	**Marks**
Correct labels	✓
Correct direction	✓
All angles correct	✓✓

(4)

2.3 $T_1 = 250 \text{ Sin } 50^\circ$ ✓= 191,51 N✓

Or

$T_1 = 250 \text{ Cos } 40^\circ$ ✓= 191,51 N✓

And

$T_2 = 250 \text{ Cos } 50^\circ$ ✓= 160,70 N✓

Or

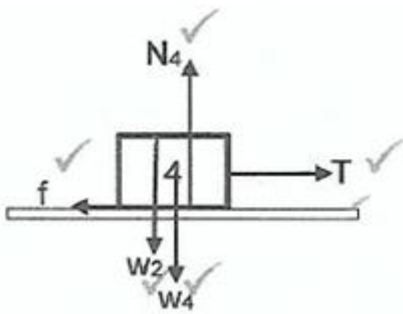
$T_2 = 250 \text{ Sn } 40^\circ$ ✓= 160,70 N✓ (4)

[12]

Question 3

3.1 When a net force is acts an object, the object will accelerate in the direction of the net force. The acceleration is directly proportional to the force and inversely proportional to the mass of the object.

3.2



(5)

3.3 $F_N = mg$ ✓ $= (4 + 2)\cdot 9{,}8$ ✓ $= 58{,}8$ N ✓ (3)

3.4 $f_k = \mu\cdot N$ ✓ $= 0{,}3\cdot 58{,}8$ ✓ $= 17{,}64$ N ✓ (3)

3.5

3 kg	6 kg
$F_{net} = ma$ ✓	$F_{net} = ma$
$W - T = m\cdot a$	$T - f = m\cdot a$
$\underline{29{,}4 - T}$ ✓ $= 3\cdot a$ ✓ 1	$T - 17{,}64 = 6\cdot a$ ✓ 2

1 + 2

$29{,}4 - 17{,}64 = 9\cdot a$ ✓

$a = \underline{1{,}31}\ \underline{m\cdot s^{-1}}$ ✓ (6)

Question 4

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 or 0) (2)

4.2 can be applied anywhere in the universe. ✓ (1)

4.3.1 $2{,}30 \times 10^{-8}$ N✓
According to Newton's third Law of motion✓ the force that the 16 kg body exerts on the 48 kg body is equal in magnitude to the force that the 48 kg body exerts on the 16 kg body. (3)

4.3.2

$$F = \frac{Gm_1m_2}{r^2} \checkmark$$

$$2{,}30\times10^{-8} \checkmark = \frac{(6{,}67\times10^{-11})(16)(48)}{r^2} \checkmark$$

$$r = 1{,}49 \text{ m}$$

$$x = 1{,}49 \checkmark \quad - (0{,}10 + 0{,}15) \checkmark$$

$$= 1{,}24 \text{ m} \checkmark$$

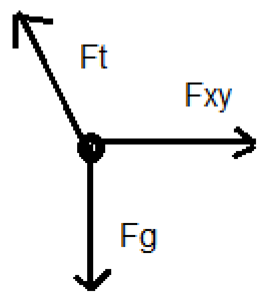
(6)

[12]

Question 5

5.1 The magnitude of the electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the charges and inversely proportional to the square of the distance between them.

5.2



-1 if no key shown

5.3 **OPTION 1 / *OPSIE 1***

$$F_E = \frac{(kQ_1Q_2)}{r^2} \checkmark$$

$$= \frac{(9\times10^9)(0,6\times10^{-6})(1\times10^{-6})}{(0,18)^2} \checkmark$$

$$= 0,1667 \text{ N}$$

$$\frac{F_E}{\sin 7^0} = \frac{T}{\sin 90}$$

$$T = \frac{(0,1667 \sin 90)}{\sin 7^0} \checkmark$$

$$= 1,367 \text{ N} \checkmark$$

OPTION 2 / *OPSIE 2*

$$F_E = \frac{(kQ_1Q_2)}{r^2} \checkmark = \frac{(T\cos 83^0)}{(T\sin 7^0)} \checkmark$$

$$T = \frac{(9\times10^9)(0,6\times10^{-6})(1\times10^{-6})}{(0,18^2)(\cos 83^0)} \checkmark$$

$$= 1,367 \text{ N} \checkmark$$

OPTION 3 / *OPSIE 3*

$F_E = \frac{(kQ_1Q_2)}{r^2}$ ✓

$= \frac{(9x10^9(0,6x10^{-6})(1x10^{-6})}{0,18^2}$ ✓

$= 0,1667$ N

$\tan 7^\circ = \frac{T_x}{T_y} = \frac{0,1667}{T_y}$ ✓

$T_Y = 1,358$

$T = \sqrt{Tx^2+Ty^2}$

$= \sqrt{0,1667^2+1,358^2}$

$= 1,368$ N ✓

OPTION 4 / *OPSIE 4*

Horizontal components

$F_{net} = 0$

$F_{el\ Y on\ x} = T_x$ ✓

$\frac{kQ_1Q_2}{r^2} = T\cos 83^\circ$

$\frac{(9x10^9)(0,6x10^{-6})(1x10^{-6})}{(18x10^{-2})^2}$ ✓ $= T\cos 83^\circ$ ✓

$T = 1,37$ N ✓ **(4)**

5.4.1 Increase ✓ **(1)**

5.4.2 The net field at X increases, ✓resulting in an increase on the force attracting X to Y and Z hence the angle increases. ✓ (2)

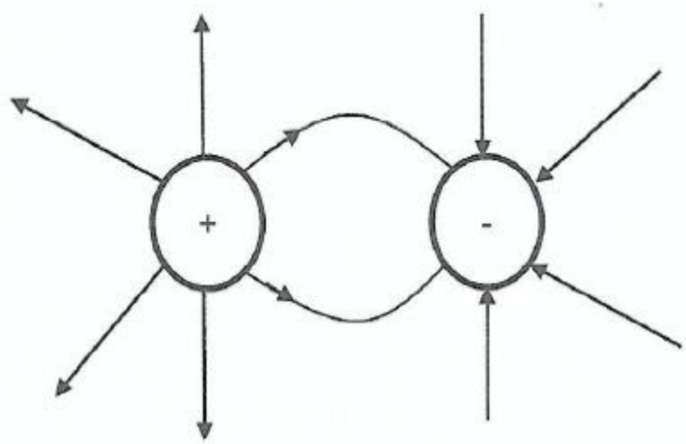
5.4.3 The insulated stands prevent the negative charges ✓ from flowing to the earth and discharging the balls. ✓

(2)
[14]

Question 6

6.1 The direction of the electric field at a point is the direction that a positive test charge would move if placed at that point.✓ ✓ (2)

6.2



✓✓✓ (3)

6.3 $E = \frac{kQ_1}{r^2} = \frac{9x10^9\,(3\,x\,10^{-6})}{(0{,}03)^2} = \underline{3 \times 10^7\ C}$ ✓

✓ $E = \frac{kQ_2}{r^2} = \frac{9x10^9\,(1\,x\,10^{-6})}{(0{,}03)^2} = \underline{1 \times 10^7\ C}$ ✓

$E_{net} = Q_1 + Q_2$

$= 3 \times 10^7 + 1 \times 10^7$ ✓ $= \underline{4 \times 10^7\ N{\cdot}C^{-1}}$ ✓ to the right✓ (6)

[11]

Question 7

7.1 Emf is the total potential difference across ✓ an electric circuit when the switch is open. ✓

OR

Emf is the energy supplied ✓ per coulomb of charge/unit charge ✓ moving through the battery (2)

7.2.1 Internal Resistance ✓ // lost volts (used up by internal r) (1)

7.2.2 0 (V) / zero ✓ (1)

7.2.3

$R = \frac{V}{I}$ ✓ (or $I = \frac{V}{R}$)

$I = \frac{4.5}{5} = 0{,}9 A$ ✓ ✓

$\frac{1}{R_p} = \frac{1}{r_1} + \frac{1}{r_2} = \frac{1}{20} + \frac{1}{30} = \frac{2+3}{60} = \frac{5}{60}$

$R_p = 12\ \Omega$

$R_{ext} = 12 + 43 = 55\ \Omega$ ✓

Emf = I (R + r) ✓ = 0,9 (55 + 5) ✓ = 0,9 x 60 = 54 V ✓ (7)

7.2.4 **Positive marking from Q** 7.2.3

$R = \frac{V}{I}$ ✓

Therefore, $V_P = I \times R_P = 0{,}9 \times 12 = 10{,}8\ V$

(OR $V_P = 49{,}5 - V_{43} = 49{,}5 - (0{,}9 \times 43) = 10{,}8\ V$)

$I_{30\Omega} = \frac{V_{30\Omega}}{R} = \frac{10{,}8}{30} = 0{,}36\ A$ ✓ ✓

(3)

7.3 Decrease.✓ Total resistance in the circuit increases.✓ Current decreases.✓ Hence, power decreases. (3)

[17]

Question 8

8.1 Internal resistance in the opposition to the flow ✓ of charge ✓ in a cell/ an ammeter (in an electric circuit.) (2 or 0)

8.2.1 3 V ✓ (1)

8.2.2 'lost' volts = 3,0 – 2,0 ✓ = 1 V ✓ OR 1 V ✓✓ (2)

8.2.3 r can be found by finding the gradient of the graph

$$\text{gradient} = \frac{\Delta I}{\Delta V} \checkmark$$
$$= \frac{0{,}4 - 0{,}6}{1 - 0} \checkmark$$
$$= \frac{-0{,}2}{1}$$
$$= -0{,}2\ \Omega^{-1}$$
$$R_{int} = 5\ \Omega \checkmark$$

(other correct values from the graph can be used for the calculation) (3)

[8]