MEMO June 2019

PHYSICAL SCIENCES GRADE 12 P1

QUESTION 1

1.1 D ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 C ✓✓
1.5 D ✓✓
1.6 A ✓✓
1.7 C ✓✓
1.8 C ✓✓
1.9 B ✓✓
1.10 B ✓✓

2.1 *The momentum of an object is the product of its mass and velocity.* ✓

2.2 $p_A = m_A v_A$ ✓
$p_A = (1\,500)(25)$ ✓
$p_A = 37\,500\ kg.m.s^{-1}$ *EAST* ✓ *(no unit & direction, no mark)*

2.3 *The total linear momentum in an isolated system is conserved.* ✓

2.4 $v_f = v_i + a\Delta t$ ✓
$0 = v_{B,after} + (-2)(7{,}5)$
$v_{B,after} = 15\ m.s^{-1}$ ✓

$\sum p_{before} = \sum p_{after}$ OR $p_{A,before} + p_{B,before} = p_{A,after} + P_{B,after}$
$37\,500 + 0$ ✓ $= 1\,500v_A + (750)(15)$ ✓
$\therefore v_A = 17{,}5\ m.s^{-1}$ ✓

2.5 $F_{ave} = \frac{\Delta p}{\Delta t}$ ✓
$F_{ave} = \frac{750(15-0)}{0{,}2}$ ✓ *OR* $F_{ave} = \frac{1\,500(17{,}5-25)}{0{,}2}$
$\therefore F_{ave} = 56\,250\ N$ ✓

2.6 *Decreases.* ✓

[14]

3.1 *Mechanical energy is conserved in an isolated system.* ✓

3.2 $v_B = 4\ m.s^{-1}$ ✓

3.3 $E_{p,C} = mgh_C$ ✓
$E_{p,C} = (0{,}01)(9{,}8)(1\sin 40°)$ ✓ *(*$1\sin 40° = 0{,}64$*)*

$\therefore E_{p,C} = 0{,}06\,J$ ✓ *(accept* $0{,}063\,J$*)*

3.4 $E_{p,C} + E_{k,C} = E_{p,B} + E_{k,B}$

$0{,}06 + E_{k,C} = 0 + \frac{1}{2}(0{,}01)(4)^2$ ✓

$E_{k,C} = 0{,}02\,J$ ✓

$E_{k,C} = \frac{1}{2}mv_C^2$ ✓

$0{,}02 = \frac{1}{2}(0{,}01)(v_C)^2$ ✓

$\therefore v_C = 2\,m.s^{-1}$ ✓

3.5 $W_{net} = \Delta E_k = E_{k,f} - E_{k,i}$ ✓

$W_{net} = 0 - 0{,}02$

$W_{net} = -0{,}02\,J$

$F_{net} = f + f_{g\parallel} = f + mg\,sin\,\theta$ ✓

$F_{net} = 0{,}05 + (0{,}01)(9{,}8)(sin\,40°)$

$F_{net} = 0{,}11\,N$

$W_{net} = F_{net}.\Delta x.cos\,\theta$ ✓

$W_{net} = (0{,}11)(\Delta x)(\cos 180°) = -0{,}02$ ✓

$\therefore \Delta x = 0{,}18\,m$ ✓

No, the marble won't reach point D. ✓

3.6 $d = 1 + 0{,}18 = 1{,}18\,m$ ✓

3.7 *Increases.* ✓

3.8 *Increases* ✓*, the marble will have <u>more kinetic energy</u>.* ✓

[19]

4.1 *Power is the <u>rate at which work is done</u>.* ✓

4.2 $P_{ave} = Fv_{ave}$ ✓

$P = (100)(9{,}8)(4)$ ✓

$P = 3\,920\,W$ ✓

4.3 $W = F.\Delta x.\cos\theta$ ✓

$W = (300)(10)(\cos 43°)$ ✓

$\therefore W = 2\,194{,}06\,J$ ✓

[7]

5.1 *The electrostatic force of attraction or repulsion between two charges is directly proportional to the product of the charges* ✓ *and inversely proportional to the square of the distance between them.* ✓

5.2 .1 $E_{net} = E_1 + E_2$ ✓

$$E_{net} = \frac{k.q_1}{r_1^2} + \frac{k.q_2}{r_2^2} \checkmark$$

$$E_{net} = \frac{(9 \times 10^9)(37 \times 10^{-9})}{(0{,}012)^2} \checkmark + \frac{(9 \times 10^9)(54 \times 10^{-9})}{(0{,}018)^2} \checkmark$$

$\therefore E_{net} = 2{,}31 \times 10^6\ N.C^{-1}$ *to the left* ✓ *(no unit & direction, no mark)*

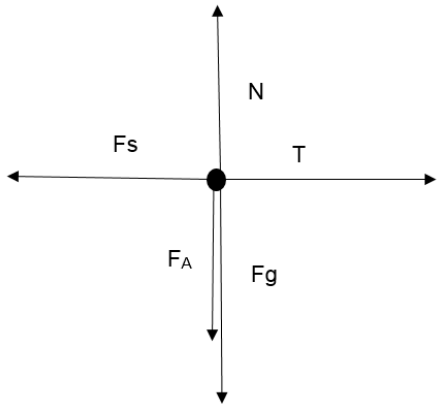
5.2.1. $F = E.q$ ✓

$F = (3{,}81 \times 10^6)(40 \times 10^{-9})$ ✓

$F = 0{,}09\ N$ *to the right* ✓ *(accept* $0{,}0924\ N$ *to the right); (no unit & direction, no mark)*

[10]

6.1



6.2 2kg block (B):

$T = F_g$

$T = 2(9{,}8)$

$T = 19{,}6N$ ✓

4 kg block (A):

$F_s = T = 19{,}6$ N✓

$F_s = \mu_s . N$ ✓

$19{,}6 = 0{,}2$ N ✓

N = 98 N ✓

$N = F_A + F_g$ ✓

$98 = F_A + 4(9{,}8)$

$F_A = 58{,}8$N ✓

6.3 When a net/resultant force acts on an object with mass, the object will accelerate in the direction of the force. The acceleration is directly proportional to the force ✓and inversely proportional to the mass of the object.✓

6.4 F = ma

$F_g - T = ma$ ✓

$2(9{,}8) - T = 2(2{,}3)$ ✓

T = 15 N ✓

6.5 $F_{net} = ma$
$T - F = ma$ ✓
$15 - F = 4(2,3)$ ✓
$F = 5,8$ N ✓

[20]

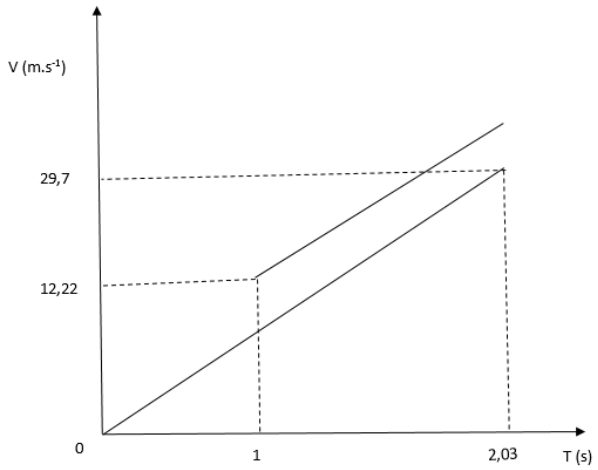
7.1.1 $v_f^2 = v_i^2 + 2a\triangle y$ ✓
$v_f^2 = 0 + 2(9,8)(45)$ ✓
$v_f = 29,70\ m.s^{-1}$ ✓

7.1.2 $v_f = v_i + a\triangle t$
$29,70 = 0 + 9,8\ \triangle t$
$\triangle t = 3,03$ s (Ball A)

Ball B is 3,03 – 1 = 2.03 s

7.1.3 $\triangle y = v_i\triangle t + ½\ a\triangle t^2$ ✓
$45 = v_i\ (2,03) + ½\ (9,8)(2,03)^2$ ✓
$V_i = 12,22\ m.s^{-1}$ ✓

7.2



[15]

8.1.1 The (apparent) change in frequency (or pitch) of the sound detected by a listener because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓✓

8.1.2 $$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$$

$$985 \checkmark = \frac{v}{(v - 10{,}6)} \checkmark (954{,}3) \checkmark$$

$$v = 340{,}1 \text{ m·s}^{-1} \checkmark$$

8.1.3 Decreases ✓

8.1.4 For a constant velocity of sound / speed ✓

if the frequency increases, λ decreases. ✓ OR $\lambda \alpha \frac{1}{f}$ or $f \alpha \frac{1}{\lambda}$ ✓ at constant velocity. ✓

8.1.5 The same✓

8.2.1 Doppler flow meter✓

8.2.2 Red-shifting✓

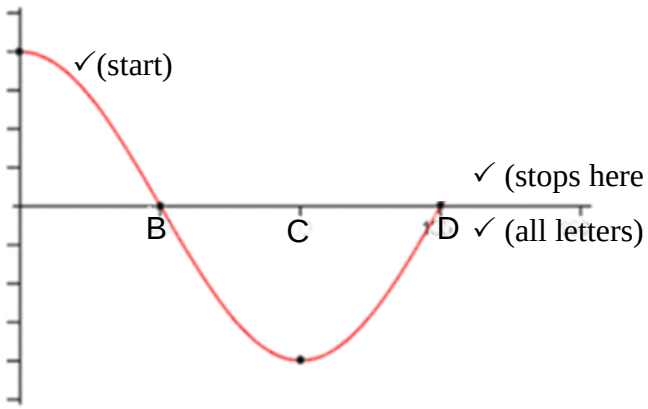
[13]

9.2.1 Mechanical ✓ to electrical✓

9.2.2 Yes ✓, it has 2 slip rings✓

9.2.3 The induced emf is directly proportional to the rate of change of magnetic flux. ✓✓

9.2.4



9.2.5 C is the maximum emf ✓ after the current changed direction✓

[11]

10.1.1 carbon brush✓

10.1.2 sliding contact bewtween moving and stationary parts✓✓

10.1.3 clockwise✓

10.1.4 DC ✓, there are permanent magnets✓

10.1.5 stronger magnets, more coils, increase current strength ✓(any one)

10.1.6 Motor effect ✓

10.1.7 a current carrying conductor will experience a force in a magnetic field. ✓✓

10.1.8 electrical ✓ to mechanical ✓

[12]

11.1 $P_{ave} = \frac{V^2}{R}$ ✓

$= \frac{220^2}{50}$ ✓

= 880 W ✓

11.2 $I_{max} = \sqrt{2} \times I_{rms}$ ✓ $= \sqrt{2} \times \frac{V_{rms}}{R} = \sqrt{2} \times \frac{220}{50}$ ✓ = 6,22 A ✓

11.3 The rms value of AC is the DC potential difference/current which dissipates the same amount of energy as AC. ✓✓

[8]
