GRADE 12 Science June P1 MEMO

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

2.1 When a net force acts on an object, the object will accelerate in the direction of the force ✓ and the acceleration is directly proportional to the (net) force and inversely proportional to the mass of the object. ✓ (2)

2.2 ✓ F_A ✓ F_N ✓ F_g ✓ f_k ✓ T

(1 mark per force with correct orientation and label) (5)

2.3 <u>9 kg box:</u>

$f_k = \mu_k N$ ✓

$f_k = (0{,}45)(9)(9{,}8)(\cos 10°)$ ✓

$(\therefore f_k = 39{,}09 \ldots N)$

$T - F_{g_\parallel} - f_k = 0$ ✓

$T = (9)(9{,}8)(\sin 10°) + 39{,}09 \ldots$ ✓

$(\therefore T = 54{,}403 \ldots)$

<u>12 kg box:</u>

$F_A - F_{g_\parallel} - T - f_k = 0$ ✓

$f_k = 120 - (12)(9{,}8)(\sin 10°) - 54{,}4 \ldots$ ✓

$\therefore f_k = 45{,}18\ N$ ✓

(7)

2.4 $\mu_k = \frac{f_k}{N}$ √ $= \frac{45{,}18}{(12)(9{,}8)(\cos 10°)}$ √ $= 0{,}39$ √ (3)

2.5
- Use boxes made from a smoother material.
- Wet the surface of the slope.
- Construct the slope with a smoother material. ✓ (ANY ONE) (1)

2.6 NO. ✓

The coefficient of friction for the two boxes is not the same indicating they are made from different materials (with one material rougher than the other). ✓ (2)

[20]

3.1 An <u>object</u> on which the <u>only force acting is gravity.</u> (2)

3.2 $v_f^2 = v_i^2 + 2a\Delta y$ ✓

$0^2 = (-5)^2 + 2(9{,}8)\Delta y$ ✓

$\Delta y = 1{,}2755 \ldots m$ ✓

$Maximum\ height = 20 + 1{,}2755 \ldots = 21{,}28\ m$ ✓

(4)

3.3

$Ball\ A:\ \Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$Height = \Delta y - 20 = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$\Delta y = 5x - 4{,}9x^2 + 20$ ✓

$Ball\ B:\ Height = \Delta y = 14x - 4{,}9x^2$ ✓

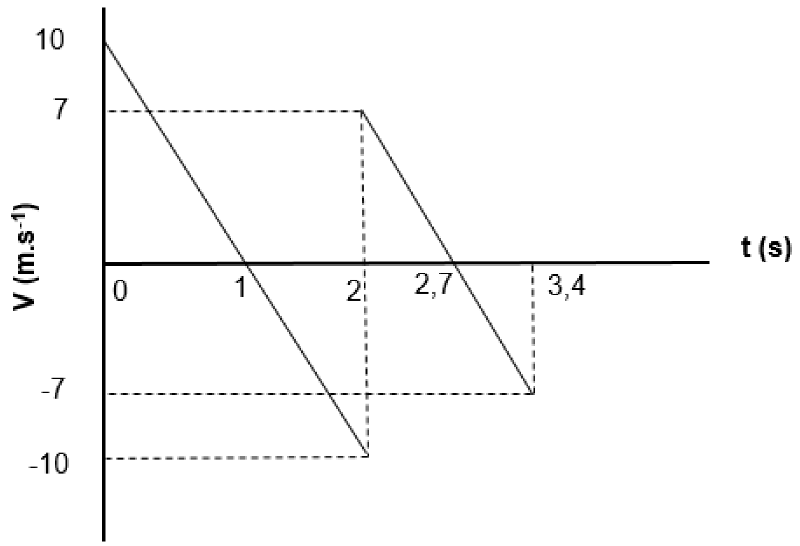
$5x - 4{,}9x^2 + 20 = 14x - 4{,}9x^2$ ✓

$x = 2{,}22\ s$ ✓

$\Delta y = 14(2{,}22) - 4{,}9(2{,}22)^2 = 6{,}91\ m$ ✓

(7)

3.4



Axis with units ✓

y-coordinates when starting bounce ✓

y-coordinates when ending bounce ✓

x-intercepts ✓

x-readings at 2 s and end ✓

(5)

3.5 Acceleration (9,8 m.s^{-2}) (1)

[19]

4.1 In an isolated system, total linear momentum is conserved. (2)

4.2 $m_T v_T + m_C v_T = m_W v_W$ ✓

$3\,500\ (28)$ ✓ $+ 750\left(-120 \times \frac{1000}{3600}\right)$ ✓ $= 4250(v)$ ✓

$v = 17{,}18\ m.s^{-1}\ east$ ✓ (5)

4.3 $\Sigma E_{ki} = \frac{1}{2} m_c v_c^2 + \frac{1}{2} m_T v_T^2$ ✓

$= \frac{1}{2}(3500)(28)^2 + \frac{1}{2}(750)(-33{,}33)^2$ ✓

$= 1\,372\,000\ J$ ✓

$\Sigma E_{kf} = \frac{1}{2}(4250)(17{,}18)^2$ ✓

$= 627\,198{,}85\ J$ ✓

$\Sigma E_{ki} \neq \Sigma E_{kf} \quad \therefore inelastic$ ✓ (6)

4.4 $F\Delta t = \Delta p$

$Impulse = m(v_f - v_i)$ ✓

$= 750\ (17{,}18 - (-33{,}33))$ ✓

$= 37\,885\ N.s$ ✓

(3)

[16]

5.1 $E_k = E_p = mgh$ ✓

$E_k = (0{,}25)(9{,}8)(0{,}6)$ ✓

$\therefore E_k = 1{,}47\ J$ ✓ (3)

5.2 $E_k = 1{,}47\ J$ ✓ + marking from 5.1 (1)

5.3.1 The <u>work done by a net force</u> (on an object) <u>is equal to the change in kinetic energy</u> (of the object).

OR The <u>net work done is equal to the change in kinetic energy</u>. ✓✓ (2 or 0) (2)

5.3.2 $W_{net} = \Delta E_k = E_{k,f} - E_{k,i} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ ✓

$(1{,}5)(0{,}3)(\cos 180°)$ ✓ $= \left(\frac{1}{2}\right)(0{,}5)\left(v_f\right)^2 - 1{,}47$ ✓ + marking from 5.1

$\therefore v_f = 2{,}02\ m.s^{-1}$ ✓ (4)

5.4.1 A force for which the work done in moving an object between two points is independent of the path taken. ✓✓ (2 or 0) (2)

5.4.2 Gravitational force. ✓ (1)

5.4.3

$$\left.\begin{aligned} &W_{nc} = \Delta E_k + \Delta E_p \\ &W_{f_k} = \left(E_{k,f} - E_{k,i}\right) + \left(E_{p,f} - E_{p,i}\right) \\ &f_k\,\Delta x \cos\theta = \left(\tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2\right) + \left(mgh_f - mgh_i\right) \end{aligned}\right\}$$ ✓ (any one)

$(1{,}5)(\Delta x)(\cos 180°)$ ✓ $= 0 - \left(\frac{1}{2}\right)(0{,}5)(2)^2$ ✓ $+ (0{,}5)(9{,}8)(\Delta x \sin 30°$ √ $) - 0$ ✓

$-1{,}5\ \Delta x = -1 + 2{,}45\ \Delta x$

$\Delta x = 0{,}25\ m$ ✓ (6)

5.5 $P = \frac{W}{\Delta t}$ ✓

$P = \frac{(0{,}25)(9{,}8)(0{,}6)}{0{,}7}$ ✓

$\therefore P = 2{,}1\ W$ ✓ (3)

[22]

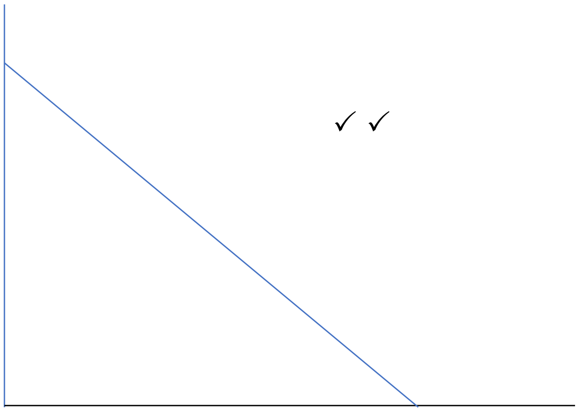
6.1.1 the change in frequency (or pitch) of the sound detected by a listener, because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓ ✓

6.1.2 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓

$880\ P = \frac{v+0}{v-30}\ P800$ ✓

v = 330 $m.s^{-1}$ ✓

6.1.3



✓ ✓

6.2 Obeserved colour looks more red – i.e. shifted to the red side of the spectrum, ✓

∴lower frequency, ✓

∴ star moving away ✓ from the observer (from doppler effect)

6.3 Doppler Flow meter ✓

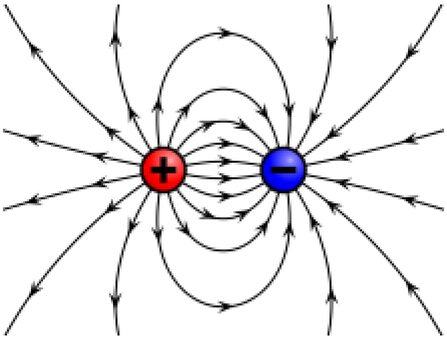
6.4 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$

$8x10^9$ ✓= $\frac{3x10^8+0}{3x10^8-v_s}$ ✓ $7{,}999999x10^9$

Vs = 55,55… = 200,00 $km.h^{-1}$ ✓

7.1 The magnitude of the electrostatic force exerted by one charge on another charge is directly proportional to the product of the magnitude of the charges and inversely proportional to the square of the distance between them (their centres). (2)

7.2



Lines perpendicular and not crossing ✓
Shape ✓
Arrow direction ✓

(3)

7.3

$$F = \frac{k\,Q_1Q_2}{r^2} \quad ✓$$

$$= \frac{9\times10^{9}(5\times10^{-9})(8\times10^{-9})\ ✓}{(2\times10^{-2})^2\ ✓}$$

$$= 9\times10^{-4}\ N \quad ✓$$

(4)

7.4

$$E_{net} = E_X - E_Y \quad ✓$$

$$= \frac{kq_X}{r_X^2} - \frac{kq_Y}{r_Y^2} \quad ✓(formula)$$

$$= \frac{9\times10^{9}\times5\times10^{-9}}{(0{,}015)^2}\ ✓ - \frac{9\times10^{9}\times8\times10^{-9}}{(0{,}035)^2}\ ✓$$

$$= 141\ 224{,}49\ N.C^{-1}\ to\ the\ left \quad ✓$$

(5)

7.5

$$E = \frac{F}{q} \quad ✓$$

$$141\ 224{,}49 = \frac{F}{1{,}6\times10^{-19}\ ✓}\ ✓$$

$$F = 2{,}26\times10^{-14}N\ ✓$$

(4)
[18]

8.1.1 Work Function = the minimum energy that an electronü in the metal needs to be emitted from the metal surface ✓ (the minimum energy needed to knock and electron out of the surface of a metal)

8.1.2 Potassium ✓ since $W_0 = hf_0$ therefore the higher the threshold frequency the higher ✓ the work function. Or $W_0 \alpha f_0$

8.1.3 $Ammeter\ will\ not\surd\ register\ a\ current\ since$

$$f = \frac{c}{l} = \frac{3 \times 10^8}{5.55 \times 10^{-7}} \surd = 5.41 \times 10^{14} < f_0\ for\ potassium\surd$$

OR $f = \frac{c}{l} = \frac{3\times10^8}{5.5\times10^{-7}} \surd = 5.45 \times 10^{14} < f_0\ \ for\ potassium\surd$

8.1.4 $E = hf_0 + E_k$ ✓

$\therefore E_k = \frac{hc}{l} - hf_0$ ✓

$= \frac{6.63\times10^{-34} \times3\times10^8}{5.5\times10^{-7}} \surd - 6.63 \times 10^{-34} \times 5.07 \times 10^{14}$ ✓

$= 2.5495 \times 10^{-20} = 2.55\ x\ 10^{-20}\ J$ ✓

8.1.5 Increase ✓

8.2.1 a) threshold frequency ✓ = x- intercept

b) work function ✓ = y- inercept

8.2.2 $W_0 = hf_0 \surd = 6.63 \times 10^{-34} \times 2 \surd = 1.326 \times 10^{-33}\ J$ ✓

Mistake in the original graph x-axis unit label.
Should have been **(x 10^{14} Hz)** *Then $W_0 = 1.326 \times 10^{-19}$ J*