

PHYSICS TRIALS – (MEMO)

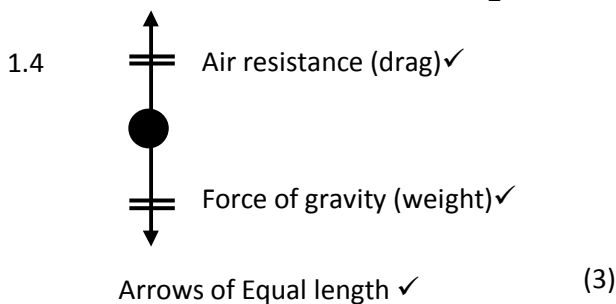
Question 1 – Sky Diving

1.1 $v^2 = u^2 + 2as$ ✓
 $v^2 = 0^2 + 2(9,72) 3900$ ✓ ✓
 $v = \underline{275 \text{ m.s}^{-1}}$ (3)
 No mark for answer since this was given.

1.2 $275 \times \frac{3600}{1000} = 990 \text{ km.h}^{-1}$ ✓ (2)

1.3 $v = u + at$ ✓
 $275 = 0 + 9,72.t$ ✓
 $t = \underline{28,35 \text{ s}}$ (3)

May use $s = u + \frac{1}{2}at^2$ or $s = \frac{(u+v).t}{2}$



- 1.5
- Cindy had a smaller mass \therefore **less gravitational force** \therefore it did not take as long for her drag to equal weight and reach terminal velocity.
 - Cindy may have adopted a **less streamlined position** eg she may have fallen belly down whereas Pravesh may have fallen feet first \therefore more drag. (2)

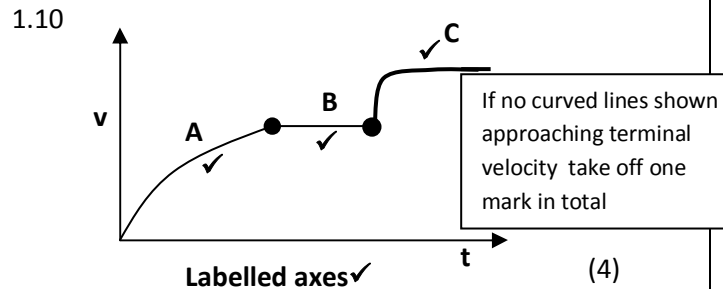
1.6 $v = 60 - 45 = 15 \text{ m.s}^{-1}$ ✓ downwards ✓ (2)

1.7 $t = \frac{\Delta s}{\Delta v} = \frac{120}{15} = 8 \text{ s}$ ✓ (2)

1.8 $m_1u_1 + m_2u_2 = (m_1 + m_2)v$ ✓
 $(64 \times 45) + (90 \times 60) = (64 + 90)v$ ✓ ✓
 $v = \underline{53,8 \text{ m.s}^{-1}}$ ✓ (4)

1.9 $F\Delta t = m\Delta v$ ✓
 $F = \frac{64(53,8 - 45)}{0,5}$ ✓
 $= 1126,4 \text{ N}$ ✓
Force of Pravesh on Cindy = 1126N (4)

OR $F = \frac{90(53,8 - 60)}{0,5}$ ✓
 $= -1116 \text{ N}$ ✓
Force of Pravesh on Cindy = 1116N (4)



If no curved lines shown approaching terminal velocity take off one mark in total

1.11 The greater the size of the parachute the lower the terminal velocity. ✓ (1)

1.12 Size of parachute. ✓ (1)

1.13 Any two reasonable answers (2)

- Body position (eg streamlined)
- Time at which parachute released.
- Altitude she jumps from \Rightarrow affects air density.
- Weather conditions \Rightarrow same day, no wind
- Same mass (will need to carry extra mass with smaller parachute)

1.14 To **eliminate errors** due to uncontrolled variables \therefore obtaining a **more accurate** result by taking an **average**. ✓ ✓ (2)

1.15 The surface area of the parachute is inversely proportional to the square of the terminal velocity. ✓ ✓ (2)

OR The greater the surface area the lower the terminal velocity ✓ (1)

OR Inverse relationship ✓ (1)

1.16 Rolling will **increase the time** over which her momentum changes. This will **decrease the force** acting on her body \therefore less chance of injury. ✓ (3)

$F = \frac{\Delta p}{\Delta t} \leftarrow \text{CONSTANT}$
 $\Delta t \leftarrow \text{BIG}$
 SMALL

Due to her inertia she will continue to move forwards as she hits the ground. ✓

[TOTAL Q1 = 42 MARKS]

Question 2 – Criminal Investigation

2.1.1 Away from Siya. ✓ (1)

2.1.2 $f_o = \frac{V}{V + V_s} \cdot f_s$ ✓
 $1100 = \frac{(342)}{(342 + V_s)} \cdot 1200$ ✓✓
 $1100(342 + V_s) = 342 \times 1200$
 $V_s = 31 \text{ m.s}^{-1}$ ✓ (4)

- 2.2
- When the green shirt was viewed under the magenta light it **absorbed the magenta light** (red + blue) ∴ appearing black. ✓✓
 - When the yellow stars (red & green) were viewed under the magenta (red & blue) light they **absorbed the blue component of the light** ✓ and **reflected the red** ✓ ∴ appearing red. (4)

2.3 $E_k = \frac{1}{2} m v^2$ ✓
 $= \frac{1}{2} \times 1200 \times 40^2$ ✓
 $= \underline{960\,000 \text{ J}}$ ✓ (3)

2.4 The work done by the resultant force acting on an object is equal to the change in its kinetic energy. ✓✓ (2)

2.5 $W = F \times s$ ✓
 $960\,000 = F \times 240$ ✓
 $\underline{F = 4\,000 \text{ N}}$. ✓ (3)

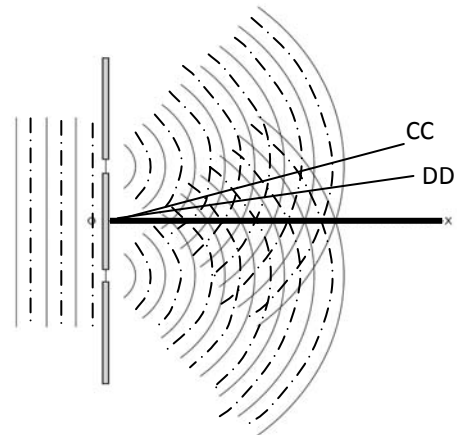
2.6 $s = \frac{(u + v) \cdot t}{2}$
 $240 = \frac{(40 + 0) \cdot t}{2}$ ✓
 $t = 12 \text{ s}$ ✓
 $P = W/t$ ✓
 $= \frac{960\,000}{12}$ ✓
 $= \underline{80\,000 \text{ W}}$ ✓ (5)

[Total Q2 = 22 marks]

Question 3 – Electromagnetic waves

3.1.1 X-rays ✓
 3.1.2 Infra red ✓ (2)

3.2.1 Visible light ✓ (1)
 3.2.2 (2)



3.2.3 Alternating black (dark) ✓ & red (bright) ✓ bands. (2)

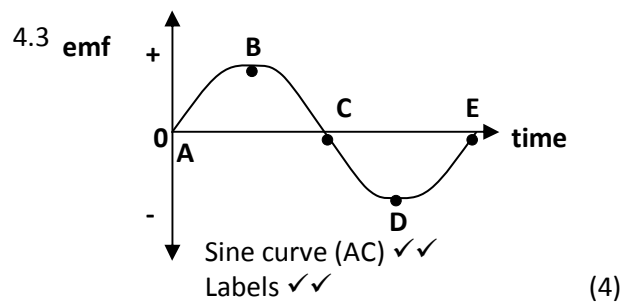
B	R	B	R	B	R	B
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3.2.4 Bands will be closer together ✓ (since blue light has a shorter wavelength ∴ it undergoes less diffraction ∴ spreads out less) (1)

[Total Q3 = 8 marks]

Question 4 – Generator

4.1 Mechanical to electrical ✓ (1)
 4.2 Clockwise. ✓ (1)



- 4.4
- Speed of rotation - faster ⇒ bigger emf
 - Magnet strength - stronger ⇒ bigger emf
 - Number of coils - more coils ⇒ bigger emf
 - Curved magnets – field lines at 90° for longer
- Two variables for 2 marks each. (4)

[Total Q4 = 10 marks]

Question 5 – Wind Power

5.1.1 **Renewable** and easily replaced / available , not used up like fossil fuels✓
Clean – no pollution✓ (2)

5.1.2

- Acceptable wind speeds ✓
- Close to Cape Town for Research and demonstration purposes.✓
- Close to existing electrical distribution infrastructure (National Grid)✓ (3)

5.1.3

- It will spoil the view ✓
- It will disturb the tranquillity (noise pollution)✓ (2)

5.1.4 If there is **no wind** or very little wind then **no electricity** (very little electricity) is produced.✓✓
 There is no guarantee of a continuous supply of wind and hence electricity.
 (2)

5.1.5 It produces **carbon dioxide**✓ which is a **greenhouse gas** contributing to **global warming**.✓ (2)
OR it is a **non-renewable**✓ fuel source (1)

5.1.6 Opinion oppressed✓
 1 mark per valid point.✓✓✓ (4)

[15]

5.2.1 Greater wind speed – more power ✓
 Bigger blade surface area – more power✓

5.2.2 **Wind speed**.✓ (Must show some figures).
 eg If the wind speed is doubled from 6 m.s^{-1} to 12 m.s^{-1} using a blade area of $3,1 \text{ m}^2$ then the current is 9,2 times greater,✓ whereas when the blade area is more than doubled from $3,1 \text{ m}^2$ to $7,1 \text{ m}^2$ for a wind speed of 10 m.s^{-1} the current is only just over 2 x greater.✓ (Can use other figures to justify your answer). (3)

5.2.3

- Change the **shape** of the blade
 Hypothesis - longer narrow blades will produce more current.
- Change the **angle** of the blade
 Hypothesis - an angle of 45° to the shaft will produce the most current.
- Change the **number** of blades
 Hypothesis - as the number of blades increases power production decreases.

Must give one change ✓ & one hypothesis✓✓

(3) [8]

5.3.1 Step-up✓ (1)

5.3.2 The power in the lines needs to be transmitted at high voltage & **low current**✓ in order to **reduce power losses**✓ in the lines ($P = I^2R$) (2)

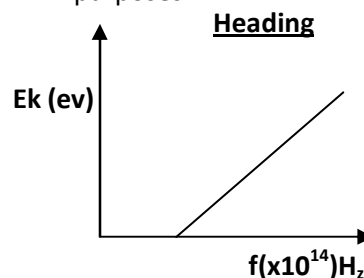
5.3.3 A.C. in the primary coil produces a **changing magnetic field**✓ which is **needed to induce an emf** (current) in the secondary coil.✓ (2)

[5]

[Total Q5 = 28marks]

Question 6 – Photo Electric Effect

6.1 see separate graph on transparency for marking purposes



Labelled axes with units.✓✓
 Points correctly plotted.✓✓
 Best fit line✓
 Cuts – x-axis✓ (6)

6.2 $\pm 5,6 \times 10^{14} \text{ Hz}$ ✓ (1)

6.3 Threshold frequency.✓ (1)

6.4 It is the minimum energy needed to emit one electron from the surface of a metal.✓✓ (2)

6.5 $W = h.f$ ✓
 $= 6,6 \times 10^{-34} \times 5,6 \times 10^{14}$ ✓
 $= \underline{3,7 \times 10^{-19} \text{ J}}$.✓ (2,3 eV) (3)

6.6.1 no effect ✓ 6.6.2 increase ✓ (2)

6.7

The **energy of each photon is the same**. ✓ **Each electron absorbs ONE photon**✓ and uses part of the energy to escape from the surface (work function) and the rest is experienced as the kinetic energy of the escaping electron. This will be the same for every electron. ✓
 There will be **more photons** ✓ colliding with electrons in the metal therefore **more electrons have the minimum energy needed to escape**✓ (energy of EM radiation is above the work function).

(5)

[Total

Q6 = 20 marks]

Question 7 – Shedding New Light

7.1

- They last (12 x) longer. ✓
- They consume $\frac{1}{5}$ of the electricity. ✓ (2)

7.2 They contain mercury ✓ which is poisonous & non-biodegradable. ✓ (2)

7.3 Aluminium; boron; gallium; Any Group 3 element. ✓ (1)

7.4

Energy efficient – it produces over 5x more lumens per watt than a normal 100 W bulb ∴ consumes less energy to produce same brightness ✓

Longest lasting – it lasts 20 years & an average incandescent light bulb lasts 1 year. ✓ (2)

7.5

Reduce electricity demands

Much lower power consumption ✓

Eliminate 258 tonnes of carbon emissions

Use less electricity ∴ burn less fossil fuels ∴ produce less CO₂. ✓

Avoid building new power plants

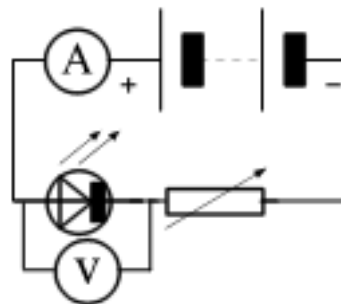
Less demand for electricity since they use less power ✓

Save ±R1 trillion

Bulbs last longer ; consume less electricity ✓

(4)

7.6.1



LED in forward bias ✓
Ammeter & voltmeter correct ✓
Rheostat ✓ (3)

7.6.2 $V = (9 - 2,4) = 6,6 \text{ V}$ ✓
 $I = (15 \div 1\,000) = 0,015 \text{ A}$ ✓
 $R = \frac{V}{I} = \frac{6,6}{0,015} = 440 \Omega$ ✓ (4)

7.6.3 $P = VI = (2,4 \times 0,015) = 0,036 \text{ W}$ ✓ (2)

[9]

[Total Q7 = 20 marks]

TOTAL : 150 MARKS