- 1
  - a
    - I
      - In Paper
    - II
      - In Paper
  - b
    - I
      - In Paper
    - II
      - In Paper
    - III
      - The model used does not account for air resistance, which would slow down the ball's velocity
- 2
  - a
    - I
      - The moment of a force is the rotational effect of a force, defined as the force multiplied by perpendicular distance between line of action of the force and the point
    - II
      - Rear set, due to the centre of mass being closer to the rear wheels.
    - III
      - In Paper
  - b
    - In Paper
  - c
    - In Paper
- 3
  - a
    - I
      - A : Cladding
      - B : Core
    - II
      - In Paper
  - b
    - In Paper
  - c

        - The core of the fibre is made to be narrow to avoid modal dispersion. This is caused by the light not entering the core at the same angle, which will spread out the signal as the light takes slightly different paths through the fibre.
    - d
        - Under-sea communication cables : This has the benefit of greatly increasing communication speed between continents, increasing co-operation between countries.
- 4
    - a
        - I
            - In Paper
        - II
            - In Paper
        - III
            - In Paper
    - b
        - I
            - In Paper
        - II
            - In Paper
    - c
        - By increasing the tension of the string, which can be achieved by using the tuning pegs on the guitar.
- 5
    - a
        - That the nature of light is that of a wave.
    - b
        - I
            - Only produces light of a single wavelength / colour.
        - II
            - Only produces light of a constant phase difference
        - III
            - Using eye protection that protects against that wavelength.
    - c
        - In Paper
    - d
        - This will decrease the fringe spacings, because due to the equation, $W = \frac{\lambda D}{s}$, The only variable changing is $\lambda$, so as $\lambda$ decreases, $W$ decreases.
- 6

- a
  - $$\text{Young Modulus} = \frac{\sigma}{\varepsilon} = \frac{\frac{F}{A}}{\frac{\Delta L}{L}} = \frac{FL}{A\Delta L}$$

    The Instruments required for measuring the Young Modulus (E) are as follows:
    - A way to hang the wire, i.e. stand + boss
    - A micrometer to measure the diameter
    - A vernier scale to measure extension ($\Delta L$)
    - A tape measure to measure the original Length ($L$)
    - Various masses of known weight
  - To begin with, take several measurements of the diameter on several points of the wire, and average it. Then, half this result to find radius (r) and find the area using the area of a circle: $A = \pi r^2$.
  - Next, Find the Length ($L$) between where the wire hangs and the vernier scale.
  - Take the initial position of the vernier scale with no masses on it.
  - Now, add a weight to the end of the wire and measure the position of the vernier scale, then find extension ($\Delta L$) by new value - initial value (of vernier).
  - The Force ($F$) will be the weight of the mass added, which can be calculated as $W = mg$.
  - Repeat these steps for several masses, then do the same while unloading the masses.
  - Determine if the elastic limit was reached, and if so only use values before the limit was broken.
  - Find the Young Modulus by plugging all measurements into the equation: $E = \frac{FL}{A\Delta L}$.
- b
  - I
    - In Paper
  - II
    - In Paper
- c

- 7
  - a
    - I
      - In Paper
    - II
      - In Paper

- lll
    - In Paper
- b
    - Wind has the advantage of not releasing $CO^2$, however it is unreliable and could have long periods of being unpowered.