11-14 Pressure

Prerequisites:

Students should have already completed the **Forces** sheet.

The Main Points

- **Pressure** measures how 'focused' a force is.
    - If pressure is low, the force is spread over a large area, which won't damage the surface or sink in (think big tractor wheels in a muddy field, or snow shoes)
    - If the pressure is high, the force is concentrated in a small area, so the surface is damaged (think sharp point on a nail or the blade of a saw or chisel)
- Students often want to say 'the pressure is spread out'. Try to prevent this. The force is spread out over a larger area, reducing the pressure.
- Pressure = Force / Area (in symbols P = F/A)
    - If area is measured in m^2, pressure is in N/m^2 = Pa (pascals)
    - If area is measured in cm^2, pressure is in N/cm^2 (newtons per square centimetre)
    - For large pressures, we use
        - 1 kPa (kilopascal) = 1000 Pa,
        - 1 MPa (megapascal) = 1000 000 Pa
- When converting areas, remember
    - 1 m^2 = 100cm x 100cm = 10 000 cm^2
      1 mm^2 = 0.1cm x 0.1cm = 0.01 cm^2
- Atmospheric pressure = 101 kPa = 101 000 Pa= 101 000 N/m^2 = 10.1 N/cm^2

Teacher Quarter Briefing

- Introduction: https://youtu.be/ZFBbtI2_-HE
  Practice: https://isaacphysics.org/gameboards#teach_quart_pressure
- Review: to follow https://youtu.be/n_Q_VDTA88M
- If you want to go further: https://isaacphysics.org/pages/covid19_gcse_archive#17a

Class Question Notes

The worksheet can be printed either in full, or in cloze text form (where the red text is missing, and students can complete these blank spaces after class discussion). The online version of the notes requires the appropriate text to be dragged to the right place in the sentences.

1. Students decide whether a high or low pressure is needed in different situations.
2. Here students choose the right words to fill in an explanation of why a chocolate bar snaps where the bar is thinnest.
3. Here students fill in a table to compare the force, pressure and area of the blade and handle of a chef's knife. The essential point is that the **forces are equal**. As the area of the blade is smaller, the pressure at the blade is larger.
4. This is the first numeric question. For a pressure of $20N/cm^2$, the student works out the force on different areas by multiplying the area in square centimetres by 20. From part (c) onwards in the online version, the student has to choose the correct unit.
5. Here the student works out pressures (force on each square centimetre) by dividing the force by the area (the number of square centimetres). From part (c) onwards in the online version, the student has to choose the correct unit.

6. Here the student works out the area given the force and the pressure (dividing the force by the pressure [being the force on each square centimetre]).
7. The student completes word equations for Force, Pressure and Area.
8. The student completes symbolic equations for F, P and A.
9. The student practises using the equations.
10. This question involves areas in square metres and pressures in Pa and kPa.

Homework Question Notes

These questions have a very similar form to the questions in the class task, so students can refer back to their earlier answers to help

1. Students fill in the blanks to explain why a farmer might put wooden boards down in a field so that their van could drive without getting stuck. The words are given.
2. Students decide whether a high or low pressure is needed in different situations and say why.
3. Here students fill in a table to compare the force, pressure and area of the head and point of a nail when it is hammered. The essential point is that the **forces are equal**. As the area of the point is smaller, the pressure at the point is larger.
4. This is the first numeric question. For a pressure of 100N/cm^2, the student works out the force on different areas by multiplying the area in square centimetres by 100.
5. This is similar to q4, but with areas in square metres and pressures in pascals. For part (d) the area is 300x larger than in (c), so the force will be 300x larger than the answer to (c).
6. Here the student works out pressures (force on each square centimetre) by dividing the force by the area (the number of square centimetres).
7. Here the student works out the area given the force and the pressure (dividing the force by the pressure [being the force on each square centimetre]).
8. The student completes word equations for Force and Pressure.
9. The student practises using the equations.
10. This question involves areas in square millimetres.

Extension questions from ‘Step Up to GCSE Physics’:
https://isaacphysics.org/gameboards#step_up_phys_34_b1