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2019 PHYSICS 2

Transcribed by: PJ Gibson

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- Give the meaning of the terms velocity gradient, tangential stress and coefficient of viscosity as used in fluid dynamics.

- Write Stokes' equation defining clearly the meaning of all symbols used.

  - State two assumptions used to develop the equation above

- Calculate the terminal velocity of the rain drops falling in air assuming that the flow is laminar, the rain drops are spheres of diameter 1 mm and the coefficient of viscosity, $\eta = 1.8 \times 10^{-5}$ Ns/m^2 .

- Water flows past a horizontal plate of area 1.2 m^2 . If its velocity gradient and coefficient of viscosity adjacent to the plate are 10 s^{-1} and 1.3×10^{-5} Ns/m^2 respectively, calculate the force acting on the plate.

- A horizontal pipe of cross - sectional area 10 cm^2 has one section of cross sectional area 5 cm^2 . If water flows through the pipe, and the pressure difference between the two sections is 300 Pa, how many cubic meters of water will flow out of the pipe in 1 minute?

- Provide one evidence which proves that sound is a wave.

- Why thunder of lightning is heard some moments after seeing the flash?

- What is Doppler effect?

- The cyclist moving at 10 m/s and the railway train at 20 m/s are approaching each other. If the engine driver sounds a warming siren at a frequency of 480 Hz:

  - calculate the frequency of the note heard by the cyclist before and after the train has passed away.

- Two sheets of a Polaroid are lined up so that their polarization directions are initially parallel. When one sheet is rotated:

- How does the transmitted light intensity vary with the angle between the polarization directions of the polaroid?
- What angle must the polaroid be rotated to reduce the light Intensity by 50% ?

• Give the meaning of the terms wave function, longitudinal wave and transverse waves.

• The equation of a Progressive wave traveling in the $+x$ direction is given by $y = a\sin(\omega t - kx)$. Show that the maximum velocity, $V_{max} = 2\pi a/T$.

• What is meant by diffraction grating?

• A diffraction grating has 500 lines per millimetre when used with monochromatic light of wavelength 6×10^{-7} m at normal incidence. Determine the angle at which the bright diffraction images will be observed.

- Why other orders of image above can not be observed?

• State Huygens's principle of wave construction.

• A lens was placed with a convex surface of radius of curvature 50.0 cm in contact with the plane surface such that Newton's rings were observed when the lens was illuminated with monochromatic light. If the radius of the 15 th ring was 2.13 mm determine the wavelength.

• Define Young's Modulus of a material.

• Why work is said to be done in stretching a wire?

• A steel wire AB of the length 60 cm and cross-sectional area 1.5×10^{-6} m^2 is attached at B to copper wire BC of length 39 cm and cross sectional area 3.0×10^{-6} m^2 . If the combination of the two wires is suspended vertically from a fixed point at A, and supports a weight of 250 N at C ; find the extension (in millimeter) of the:

- steel wire.
- copper wire.

• Based on the kinetic theory of gases determine:

- The average translational kinetic energy of air at a temperature of 290 K.
- The root mean square seed (r.m.s) of air at the same temperature (above).

• Define the terms electric potential and electric field-strength E at a point in the electrostatic field.

- How the two quantities above related?

• Outside the sphere, a charged sphere behaves like its charges were concentrated at the centre. If the electric field strength inside the sphere is zero and one sphere of radius 5.0 cm carries a positive charge of 6.7 nC, calculate;

- the potential at the surface of the sphere.
- the capacitance of the sphere.

• What is meant by dielectric constant?

- State Coulomb's law of force between two electrically charged bodies.

- Can there be a potential difference between two adjacent conductors carrying the same positive charge? Give a reason.

- A parallel plate capacitor with air as a dielectric has plates of area 4.0×10^{-2} m^2 which are 2.0 mm apart. The capacitor is charged to 100 V battery and connected in parallel with a similar unchanged capacitor with plates of half the area and twice the distance apart. If the edge effect is neglected, calculate the final charge on each plate.

- Derive an expression for the total capacitance of two capacitors C_1 and C_2 connected in series.

- Two capacitor of 15 μF and 20 μF are connected in series with a 600 V supply. Calculate the charge and Potential difference across each capacitor.

- Based on Balmer series of hydrogen spectra determine the wavelength of the series limit of Paschen series.

- Why electrons do not fall into the nucleus due to electrostatic force of attraction?

- Why hydrogen atom is stable in the ground state?

- According to Bohr's theory, the angular momentum of an electron is an integral multiple of $h/2\pi$. Express this statement. by using a mathematical equation in which angular momentum is represented by the letter Land orbit by the letter n ,

- Determine the angular momentum of the electron in the orbit of energy level -3.4 eV given that $E_n = -13.6/n^2$ eV, where E is the energy of an electron and n is the principal quantum number of hydrogen atom.

- What is meant by the following terms as used in nuclear Physics?

    - Mass defect
    - Binding energy.

- Elaborate two aspects on which fission reactions differs from fusion reactions.

- Why is high temperature required to cause nuclear fusion?

- Identify four factors that affect the force experienced by a current-carrying conductor in a magnetic field.

- Write the mathematical expression which define magnetic flux density and use it to deduce its S.I. units.

    - Apply an expression obtained above to develop the formula for the force on a conductor carrying current i if the conductor and the magnetic fields are not at night angles.

- Distinguish the terms magnetically soft and magnetically hard materials.

- State the condition which makes the magnetic force on a moving charge in a magnetic field to be maximum.

- Determine the magnitude of force experienced by a stationary charge in a uniform magnetic field.

- At which position of the rotating coil in the magnetic field, the induced e.m.f. is zero? Give a reason.

- Use mathematical expression to justify the statement that there will be no change in the kinetic energy of a charged particle which enters a uniform magnetic field when its initial velocity is directed parallel to the field.