CLASS-3

Applied Physics

Hydrostatics – Density, Archimedes' Principle

1. Short Note: Density and relative density
2. Distinguish between mass and weight.
3. Shortly explain Archimedes' Principle and Law of flotation.
4. A tank 2.2 m by 1.3 m by 2.0 m when filled contains 5.834 tonnes of dock water. Find the R.D. of the dock water.
5. A spherical bullet 0.80cm diam has a mass of 3.6g. find the density of the metal in the bullet.

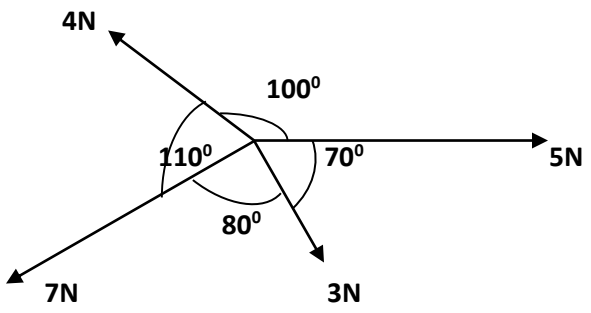
6. An iceberg R.D. 0.92 floats in sea water R.D. 1.024 with 1200m^3 exposed. Find the total volume of the iceberg. Hence determine the fraction of the iceberg below the water-line.

Hydrostatics- Force, Pressure, Thrust

1. Distinguish between pressure and thrust.
2. Derive the formula for finding the pressure at a depth in the surface of the sea.
3. Find the thrust on a ship's bottom plate 8m by 3.5m. Ship's draught 4.16m in sea water R.D. 1.024.
4. Two tonnes of sea water are contained in a rectangular tank whose base is 2.4m by 1.6m. Calculate the pressure on the tank bottom.
5. A plate on a ship's side is 4m x 1.2m wide, the upper edge being 2.6m below the surface. Calculate the thrust on the plate when the ship is floating in S.W. of relative density 1.025.

Statics – Addition of vectors

1. Forces of 6,5,4,3 kgf act in directions 000^0, 060^0, 120^0, 225^0, respectively. Find the resultant force by resolving into vertical and horizontal components.
2. Four forces act on a ringbolt as follows: 160 kgf in direction 090^0, 200kgf at 000^0, 300kgf at 315^0, 120 kgf at 240^0. Calculate the magnitude and the direction of the resultant force on the ringbolt.
3. Find the magnitude & direction of the resultant of each of the following systems of forces.



Statics – Moments, Centres of Gravity

1. What is moment of force? Explain the conditions of being equilibrium.
2. A beam AB, 12m long weighs 400 kg. At A it carries a load of 60 kg and at B a load of 240 kg. Find the C.G. of the loaded beam.
3. A vessel of 14000t displacement and centre of gravity at G discharges 2400t of cargo from No. 4 hold, the C.G. of the discharge's cargo being 6.12m abaft G, Find the movement of the C.G. of the vessel.

Statics – Couples, Stress, Strain, Bending moment and shearing Forces

1. Shortly explain Hooke's law.
2. Distinguish between stress and strain.
3. A load of 15N attached to the end of a wire 2.9m long and cross-sectional area 2 x 10^{-7} m^2 stretches it by 2 mm. Calculate: (a) the applied stress (b) the strain (c) Young's modulus

Dynamics Velocity, Acceleration, Force, Momentum

1. Shortly describe the laws of motion.
2. Distinguish between acceleration and retardation.
3. What is conservation of momentum?
4. A train starts from rest with acceleration ,3 m/s^2. Find it's velocity after 3 mins. If it is now acted upon by a retardation of .4m/s^2. After how long would it come to rest?
5. A body starts from rest with an acceleration of 6.5 m/s^2. In what time will it attain a velocity of 130 km/h?
6. A train of mass 210t starts from rest with constant acceleration and after 1 min 28 secs is travelling at 40 km/h. Find the force applied by the engine.
7. A man on the top of a tower 12 m high throws a stone vertically upwards with an initial velocity of 30 m/s. After what time will it hit the ground?

Dynamics- Energy, Work, Power, Machines

1. Prove that, Kinetic Energy = ½ mv^2
2. A chain weighing 12 kg/m and 200m long hangs vertically with a load of 2 tonnes on the end. Find the work done in winding up chain and load.
3. An object of mass 2 kg is fired vertically upwards from sea-level. At the instant it reaches a height of 60m it is travelling at a velocity of 30 m/s. At this instant calculate the object (a) Potential Energy (b) Kinetic Energy.
4. How long would it take a winch developing 15KW to raise a load of 3 tonnes through 23m at uniform speed?
5. A 15KW pump is delivering water into a tank at an average height of 12.5m. How many tone per hour will it deliver?

Heat – General Introduction, Thermometry

1. Write down the difference between temperature and heat.
2. Shortly explain convection, conduction and radiation with sketches.
3. Short Notes: land breeze, sea breeze
4. On a certain day the readings on a Celsius and Fahrenheit thermometer were the same. What was the temperature?
5. How does a thermocouple works? What is the purpose of thermocouple?
6. Distinguish between thermocouple and thermometer.

Heat – Units, Specific heat Capacity, Thermodynamics

1. Write down about specific heat capacity.
2. Shortly describe the laws of thermodynamics.
3. 44kg of ice at 92^0C is mixed with some water which is at a temperature of 20^0C. The final temperature of the mixture is 69.5^0C. Calculate the amount of water.
4. A mass of 10 kilos in descending a distance of 15 metres is made to stir 2 kilos of fresh water by means of paddles. If all the energy lost by the mass goes into heating the water, calculate the rise in temperature of the water.
5. 60 kg of water at 80^0C are mixed with 12 kg of water at 14^0C, contained in a vessel of mass 1260kg and c = 1260 j/kg^{0}C. Find the resulting temperature.

Heat – Thermal Expansion

1. Define the terms: (i) An adiabatic process (ii) An isothermal process
2. A cylinder contains a fixed volume of oxygen at 40°C the gauge showing 2.2 bar. What would the gauge read if the temperature fell at 5°C?
3. 8m^3 of air in a closed boiler exert a pressure of 60kN/m^2 at 20°C. What pressure would it exert at 60°C?
4. Derive the ideal gas equation using Boyle's law and charles' law.
5. Find the gas constant for oxygen if oxygen has a density of 1.429 kg/m^3 at S.T.P. (R.D. mercury = 13.6)
6. A vessel of 1000 litre capacity contains air at a pressure of 1.0132 bar and temperature 0°C. Air is pumped in until the pressure is 8.40 bar and the temperature is 81°C. Find the mass of air pumped in. Take r for air = 0.287×10^3 J/Kg/K.
7. A gas of volume 260 litres at S.T.P. is expanded adiabatically to 510 litres. Calculate its new pressure. Hence find its final temperature. Assume γ = 1.4.
8. The pressure of 1000 litres of a gas is changed from 140 kN/m^2 to 80 kN/m^2 by means of adiabatic expansion. Calculate the gas's final volume given that γ = 1.3.
9. A gas at an initial pressure 1 bar, initial temperature 47°C , initial volume 300cc , is compressed in a cylinder by a piston to a volume of 100cc , when its temperature is found to be 177°C. Calculate the final pressure of the gas.

Heat – Change of state, Latent heat, Vaporization

1. What is critical temperature. What is its importance in refrigeration?
2. Draw a block diagram of a basic refrigeration cycle, naming all the parts and explaining their action.
3. Define specific latent heat of vaporization.
4. Find the heat required to raise 10 kg of dry ice at -12^0C to water at 15^0C. (Specific heat capacity of dry ice = 2100 j/kg^{0}C and specific latent heat of fusion of ice = 336×10^3 J/kg)
5. How much heat is required to bring 20 kg of ice at 0^0C up to 30^0C?

Magnetism

1. Define flux density, permeability, relative permeability, Field intensity, Susceptibility

2. Short Notes: Pole strength, intensity of magnetism, Dip, Ferromagnetic Materials, Magnetic Variation.

3. Briefly describe molecular theory of magnetism and law of magnetism.
4. A bar of soft iron of length 150 cm & cross section area 2 cm^2 is in a magnetic field of total intensity 3.5×10^3 amp/m in the direction of it's length, when its pole strength is found to be 13.0 wb. Find the magnetic moment of the bar, the intensity of magnetization, and the susceptibility of the iron.

5. A specimen of iron of relative permeability 3000 is placed in a field of magnetizing force 2.0×10^2 amp/m. Calculate its absolute permeability (μ) and the flux density in the iron.

6. A solenoid is made up in four layers, each having 12 turns per cm, and a current of 10A is passing. Calculate (a) the field intensity inside the coil (b) the flux density (c) the flux density when an iron core of relative permeability 4000 is placed inside the coil.

Electricity

1. Differentiate between conductor and insulator. Write down the advantages of AC over DC.
2. Write down the factors of affecting parallel plate capacitor
3. Three capacitors of value 2, 5 and 10 microfarads, are connected in series to a 100 d.c. supply. Calculate (a) the total capacitance (b) the charge stored on each capacitor (c) the voltage across each capacitor.
4. Briefly explain the heating effect of a current.
5. Short Notes: (a) Galvanometer (b) Primary cell (c) Secondary Cell (d) Rectification
6. Write down Ohm's Law. What is difference between EMF and P.D.?
7. State the formula connecting watts, volts and amps. A lamp is rated at 100 Watts for a 240 V circuit. What is the resistance of the lamp? It is now connected up in a 200V circuit. What current is it passing and what power is it using?
8. A lamp is rated at 60W for a 240V circuit. If it is now connected up in a 216V circuit, what current is it passing and what power is it taking?

9. An alternating voltage of 240V and frequency 50Hz is applied to an inductance of 5H. Find its inductive reactance. Hence find the current.

10. Define Resonance. Prove that resonant frequency, $f_r = \frac{1}{2\pi\sqrt{LC}}$

11. An inductance of 4H with resistance 200 ohm is in series with a 64 μF capacitor and a 1000 ohm resistor in a 200V 50Hz supply. Calculate the current through the circuit and the power taken. Find also the resonance frequency of the circuit and the impedance of the circuit at resonance frequency.

12. Find the capacitive reactance when a 60 microfarads capacitor is connected to a 240V (R.M.S.), 50Hz supply. Determine the R.M.S. current.

13. Write down the difference between ac motor and generator.

14. Write down the necessary precautions in uses of electrical equipment on board ship.

15. Distinguish between fuse and circuit breaker.

Light

1. Define reflection? Write down the laws of reflection.

2. What is refraction? Write down the laws of refraction.

3. Explain the principle of sextant with geometrical proof.

4. Short Notes: (a) Real image (b) virtual image (c) Eclipse (d) Linear Magnification

5. Explain the principle of Kelvin Azimuth Mirror.

6. Calculate the position of the image formed in a concave lens of focal length 40 mm when an object is placed (a) 20 mm (b) 100 mm in front of it.

7. A convex lens of focal length 40 mm has an object 10 mm tall placed in front of it. Calculate the position, size and nature of the image formed when the object is placed 40 mm in front of the mirror.

8. Give the formula for determining μ in terms of the angle of incidence and the angle of refraction. Taking μ air into glass as ½, calculate the angle of refraction for a ray incident on the surface of a glass block at 32 degree.

Sound

1. Derive the relationship between velocity, wavelength and frequency.

2. State the effect on the velocity of sound through the atmosphere if:
   (i) the humidity of the air increases;
   (ii) the atmospheric pressure decreases;
   (iii) the temperature of the air rises;

3. The velocity of sound was measured to be 331 m/s at 0^0C. At what temperature would its velocity be 350m/s?

4. Short Notes: (a) Doppler Effect (b) Echo (c) Sky wave (d) Ground wave

5. State a formula for calculating the velocity of sound in air and explain the meaning of the terms in it. Calculate the velocity of sound in air if the barometer pressure that day is 75.4 cm mercury and the density of air is 1.30 kg/m^3. (R.D. mercury 13.6 and g = 9.81 m/s^2).

6. A launch approaching a cliff at reduced speed sounds a short blast and the echo is heard after 10 seconds. Five minutes after sounding the first blast and the echo is heard after 8 seconds. What is the speed of the launch? (Velocity of the sound = 330 m/s).
7. What is the difference between radio receiver and transmitter
8. Write down the functions of marine communication.