PHYSICS

BOOKS - MODERN PUBLICATION

Unit test - Properties of bulk matter

Example

1. A steel wire of length 4.7 m and cross-sectional area $3.0 \times 10^{-5} m^2$ stretches by the same amount as a copper wire of length 3.5 m and cross-sectional area of $4.0 \times 10^{-5} M^2$ under a given load. What is the ratio of the Young's modulus of steel to that of copper?

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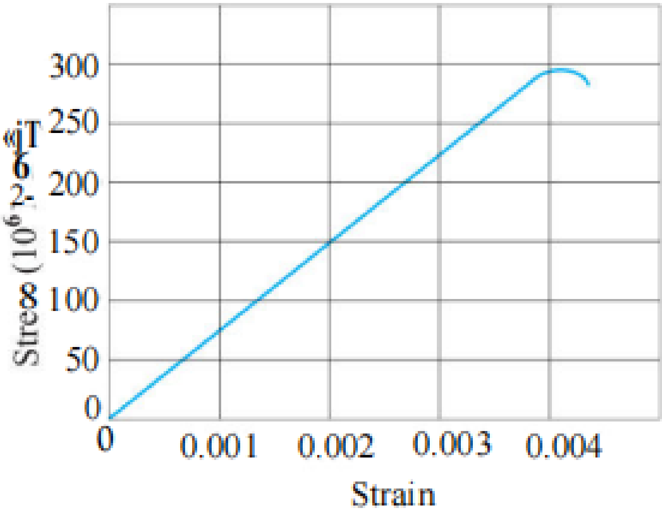
2. Figure 9.11 shows the strain-stress curve for a given material. What are Young'sb modulus :



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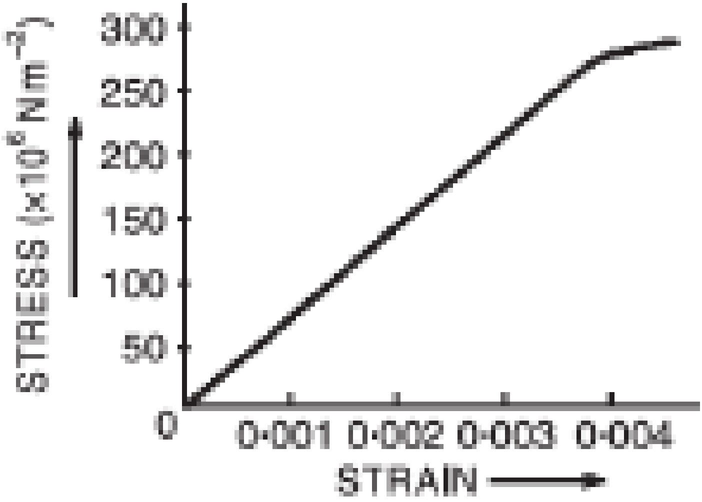
3. Fig. shows the stress-strain curve for a given material. What are approximate yield strength for this material ?



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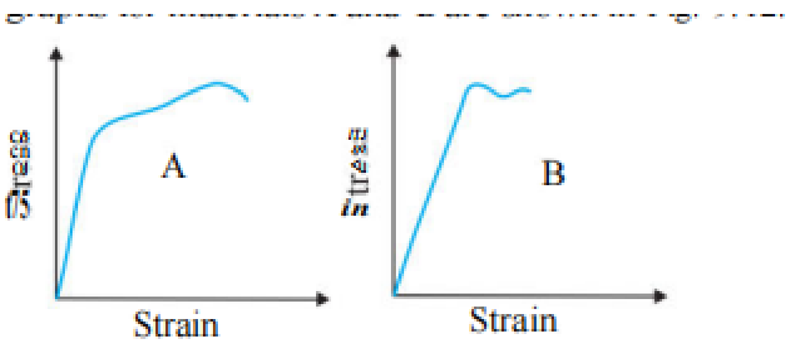
4. The stress-strain graphs for materials A and B are shown in Fig. 9.12.Tire graphs are drawn to the same scale. Which of the materials has the greater Young's modulus:



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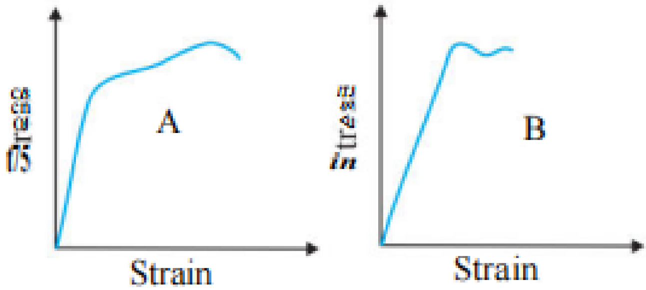
5. The stress-strain graphs for materials A and B are shown in Fig. 9.12.Tire graphs are drawn to the same scale) Which of the two is the stronger material?



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6. Read the following two statements below carefully and state, with reasons, if it is true or false. The Young's modulus of rubber is greater than that of steel,

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7. Read the following two statements below carefully and state, with reasons, if it is true or false. The stretching of a coil is determined by its shear modulus.

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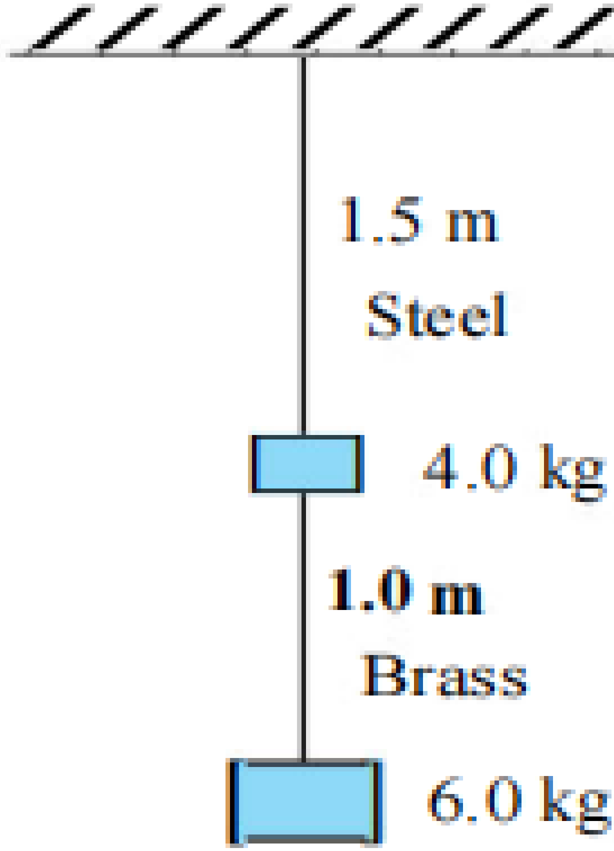
8. Two wires of diameter 0.25 cm, one made of steel and the other made of brass are loaded as shown in Fig. 9.13. The unloaded length of steel wire is 1.5 m and that of brass wire is 1.0 m. Compute the elongations of the steel and the brass wires:



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9. The edge of an aluminium cube is 10 cm long. One face of the cube isfirmly fixed to a vertical wall. A mass of 100 kg is then attached to the opposite face of the cube. The shear modulus of aluminium is 25 GPa. What is the vertical deflection of this face?

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10. Four identical hollow cylindrical columns of mild steel support a big structure of mass 50,000 kg. The inner and outer radii of each column are 30 and 60 cm respectively. Assuming the load distribution to be uniform, calculate the compressional strain of each column.

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11. A piece of copper having a rectangular cross-section of $15.2mm \times 19.1mm$ is pulled in tension with 44,500 N force, producing only elastic deformation. Calculate the resulting strain?

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12. A steel cable with a radius of 1.5 cm supports a chairlift at a ski area. If the maximum stress is not to exceed $10^8 Nm^{-2}$, what is the maximum load the cable can support ?

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13. A rigid bar of mass 15 kg is supported symmetrically by three wires each 2.0 m long. Those at each end are of copper and the middle one is of iron. Determine the ratios of their diameters if each is to have the same tension.

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14. A 14.5 kg mass, fastened to the end of a steel wire of unstretched length 1.0 m, is whirled in a vertical circle with an angular velocity of 2 rev/s at the bottom of the circle. The cross-sectional area of the wire is 0.065 cm^2. Calculate the elongation of the wire when the mass is at the lowest point of its path.

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15. Compute the bulk modulus of water from the following data: Initial volume = 100.0 litre, Pressure increase = 100.0 atm (1 atm = 1.013×10^5 Pa). Final volume = 100.5 litre. Compare the bulk modulus of water with that of air (at constant temperature). Explain in simple terms why the ratio is so large.

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16. What is the density of water at a depth where pressure is 80.0 atm, given that its density at the surface is $1.03 \times 103kgm^{-3}$?

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17. Compute the fractional change in volume of a glassslab, when subjected to a hydraulic pressure of 10 atm.

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18. Determine the volume contraction of a solid copper cube, 10 cm on an edge, when subjected to a hydraulic pressure of 7.0×10^6 Pa.

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19. How much should the pressure on a litre of water be changed to compressit by 0.10%?

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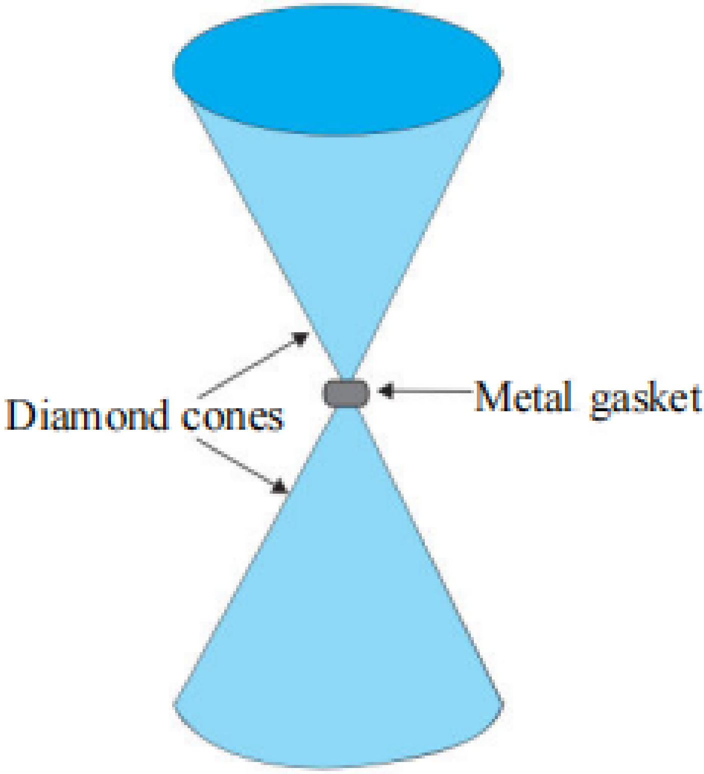
20. Anvils made of single crystals of diamond, with the shape as shown in Fig. 9.14, are used to investigate behaviour of materials under very high pressures. Flat faces at the narrow end of the anvil have a diameter of 0.50 mm, and the wide ends are subjected to a compressional force of

50,000 N. What is the pressure at the tip of the anvil?:



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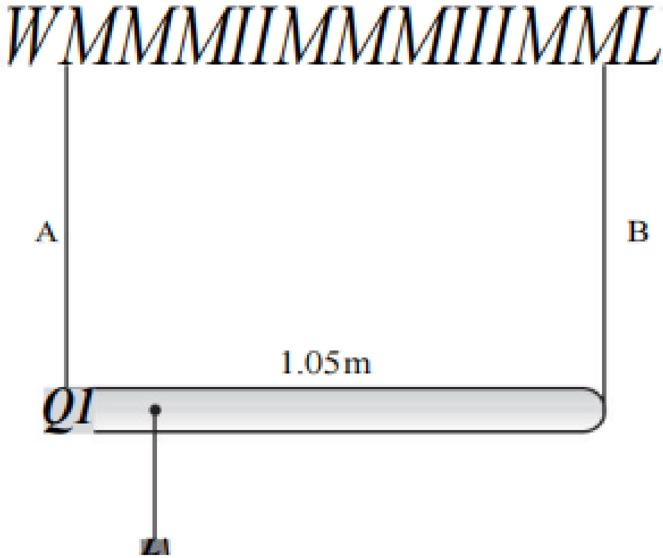
21. A rod of length 1.05 m having negligible mass is supported at its ends by two wires of steel (wire A) and aluminium (wire B) of equal lengths as shown in Fig. 9.15. The cross-sectional areas of wires A and B are $1.0mm^2$ and $2.0mm^2$, respectively. At what point along the rod should a mass m be suspended in order to produce (a) equal stresses :



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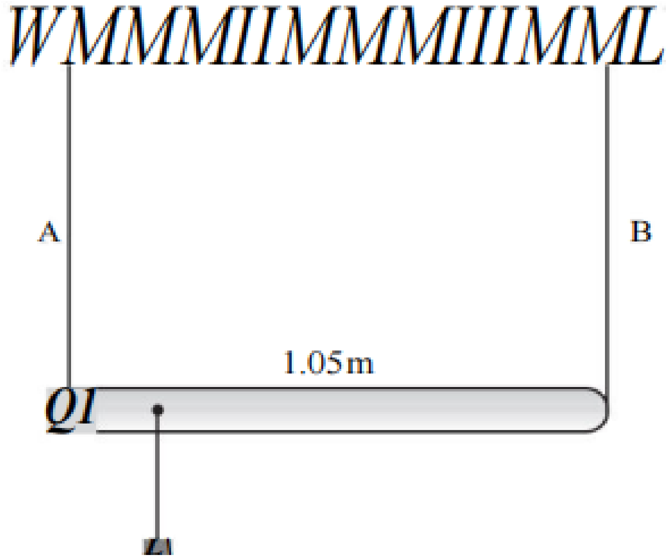
22. A rod of length 1.05 m having negligible mass is supported at its ends by two wires of steel (wire A) and aluminium (wire B) of equal lengths as shown in Fig. 9.15. The cross-sectional areas of wires A and B are $1.0mm^2$ and $2.0mm^2$, respectively. At what point along the rod should a mass m be suspended in order to produce equal strains in both steel and aluminium wires.:



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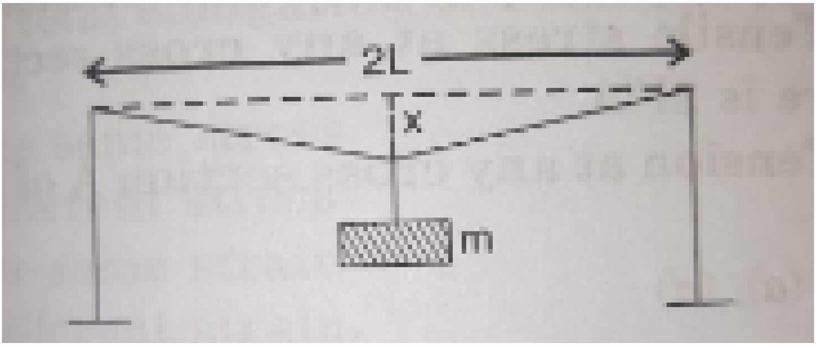
23. A mild steel wire of length 2L and cross-sectional area A is stretched, well within elastic limit, horizontally between two pilars show in the figure A mass m is suspended from the mid point of the wire. Strain in the wire is .



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24. Two strips of metal are riveted together at their ends by four rivets, each of diameter 6.0 mm. What is the maximum tension that can be exerted by the riveted strip if the shearing stress on the rivet is not to exceed 6.9×10^7 Pa? Assume that each rivet is to carry one quarter of the load.

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25. The Marina trench is located in the Pacific Ocean, and at one place it is nearly eleven km beneath the surface of water. Hie water pressure at the bottom of the trench is about 1.1×10^8 Pa. A steel ball of initial volume $0.32m^3$ is dropped into the ocean and falls to the bottom of the trench. What is the change in the volume of the ball when it reaches to the bottom?

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26. Explain why The blood pressure in humans is greater at the feet than at the brain?

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27. Explain why Atmospheric pressure at a height of about 6 km decreases to nearly half of its value at the sea level, though the height of the atmosphere is more than 100 km

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28. Explain why Hydrostatic pressure is a scalar quantity even though pressure is force divided by area.

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29. Explain why The angle of contact of mercury with glass is obtuse, while that of water with glass is acute.

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30. Explain why Water on a clean glass surface tends to spread out while mercury on the same surface tends to form drops. (Put differently, water wets glass while mercury does not.)

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31. Explain why Surface tension of a liquid is independent of the area of the surface

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32. Explain why Water with detergent disolved in it should have small angles of contact.

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33. Explain why A drop of liquid under no external forces is always spherical in shape.

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34. Fill in the blanks using the word(s) from the list appended with each statement: Surface tension of liquids generally . . . with temperatures (

$\in creases/decreases$)

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35. Fill in the blanks using the word(s) from the list appended with each statement: Viscosity of gases . . . With temperature, whereas viscosity of liquids . . . With temperature ($\in creases/decreases$)

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36. Fill in the blanks using the word(s) from the list appended with each statement: For solids with elastic modulus of rigidity, the shearing force is proportional to ... , while for fluids it is proportional to . . . ($shearstra \in /rateofshearstra \in$)

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37. Fill in the blanks using the word(s) from the list appended with each statement: For a fluid in a steady flow, the increase in flow speed at a constriction foliows ($conservationofmass / Bernol\underline{l}i\text{'}spr \in cip \leq$)

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38. Fill in the blanks using the word(s) from the list appended with each statement:For the model of a plane in a wind tunnel, turbulence occurs at a ... speed for turbulence for an actual plane ($greater / smal \leq r$)

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39. Explain why To keep a piece of paper horizontal, you should blow over, not under, it

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40. Explain why When we try to close a water tap with our fingers, fast jets of water gush through the openings between our fingers

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41. Explain why The size of the needle of a syringe controls flow rate better than the thumb pressure exerted by a doctor while administering an injection

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42. Explain why A fluid flowing out of a small hole in a vessel results in a backward thrust on the vessel

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43. Explain why A spinning cricket ball in air does not follow a parabolic trajectory

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44. A 50 kg girl wearing high heel shoes balances on a single heel. The heel is circular with a diameter 1.0 cm. What is the pressure exerted by the heel on the horizontal floor ?

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45. Toricelli's barometer used mercury. Pascal duplicated it using French wine of density $984 kgm^{-3}$. Determine the height of the wine column for normal atmospheric pressure.

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46. A vertical off-shore structure is built to withstand a maximum stress of 10^9 Pa. Is the structure suitable for putting up on top of an oil well in the ocean ? Take the depth of the ocean to be roughly 3 km, and ignore ocean currents.

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47. A hydraulic automobile lift is designed to lift cars with a maximum mass of 3000 kg. The area of cross-section of the piston carrying the load is $425cm^2$. What maximum pressure would the smaller piston have to bear ?

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48. A U-tube contains water and methylated spirit separated by mercury. The mercury columns in the two arms are in level with 10.0 cm of water in one arm and 12.5 cm of spirit in the other. What is the specific gravity of spirit ?

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50. Can Bernoulli’s equation be used to describe the flow of water through a rapid in a river? Explain.

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51. Doesit matter if one uses gauge instead of absolute pressuresin applying Bernoulli's equation ? Explain

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52. Glycerine flows steadily through a horizontal tube of length 1.5 m and radius 1.0 cm. If the amount of glycerine collected per second at one end is $4.0 \times 10^{-3} kgs^{-1}$, what is the pressure difference between the two ends of the tube ? (Density of glycerine = $1.3 \times 10^{3} kgm^{-3}$ and viscosity of glycerine = 0.83 Pa s). [You may also like to check if the assumption of laminar flow in the tube is correct].

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53. In a test experiment on a model aeroplane in a wind tunnel, the flow speeds on the upper and lower surfaces of the wing are $70 ms^{-1}$ and $63 ms^{-1}$ respectively. What is the lift on the wing if its area is $2.5 m^{2}$? Take the density of air to be $1.3 kgm^{-3}$

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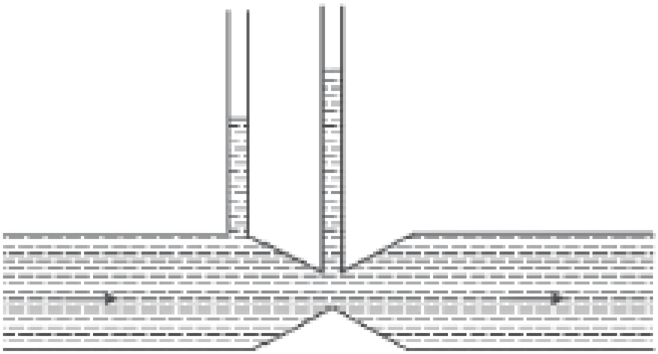
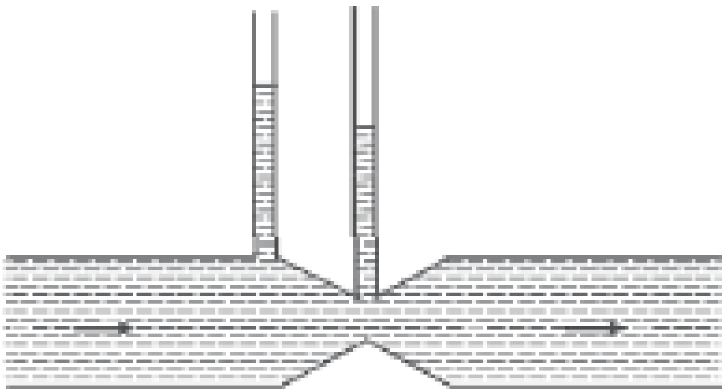
54. Figures refer to the steady flow of a non-viscous liquid. Which of the two figures is incorrect? Why?





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55. The cylindrical tube of a spray pump has a cross-section of $8.0 cm^2$ one end of which has 40 fine holes each of diameter 1.0 mm. If the liquid flow inside the tube is $1.5m \text{ min}^{-1}$, what is the speed of ejection of the liquid through the holes ?

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56. A U-shaped wire is dipped in a soap solution, and removed. The thin soap film formed between the wire and the light slider supports a weight of $1.5 \times 10^{-2} N$ (which includes the small weight of the slider). The length of the slider is 30 cm. What is the surface tension of the film ?

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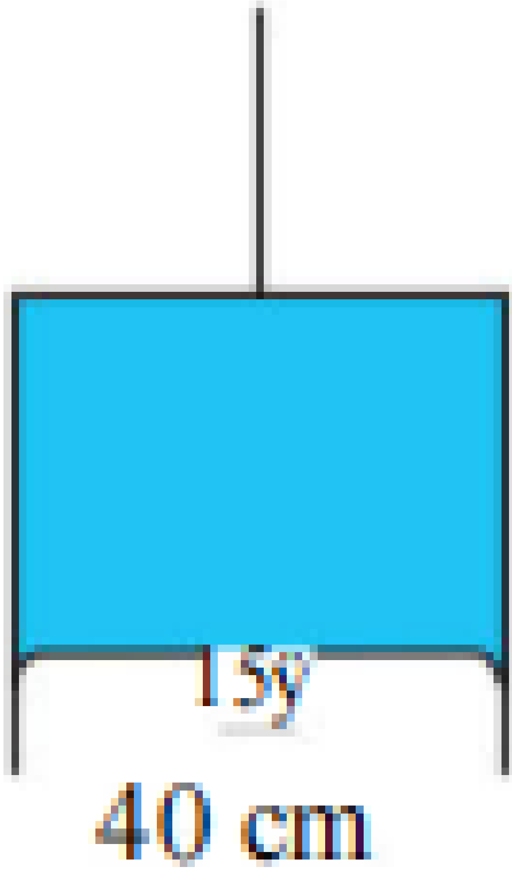
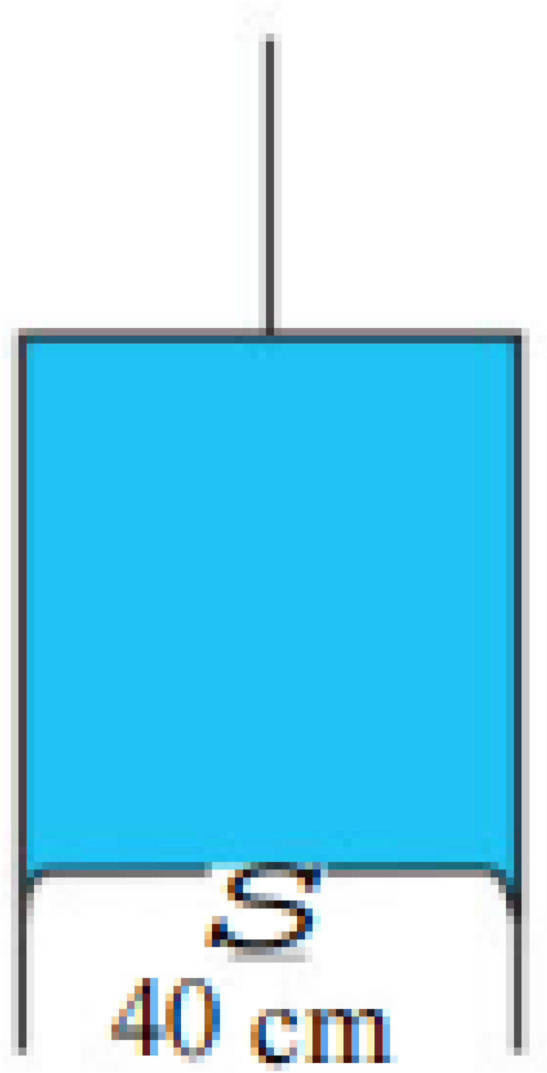
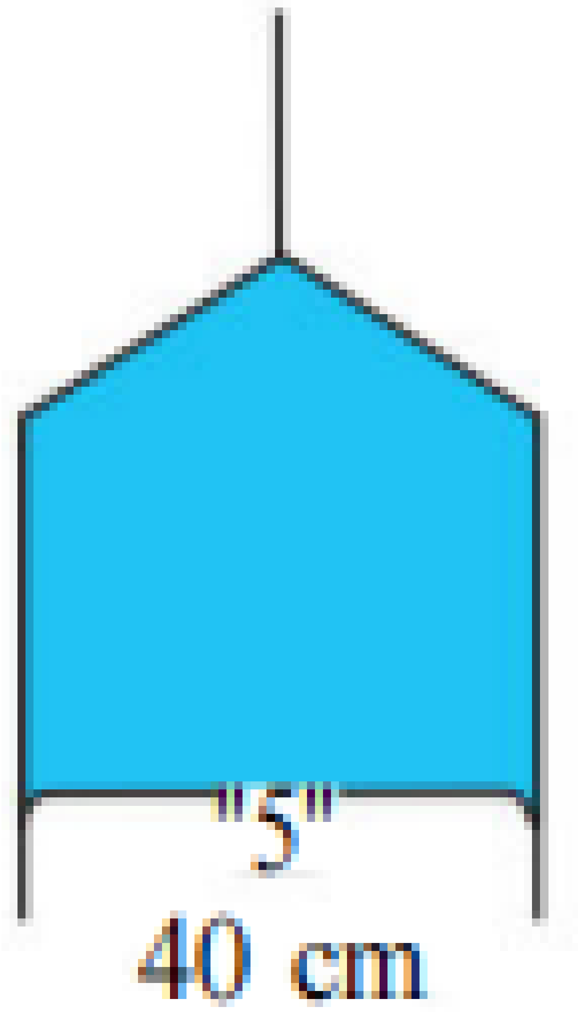
57. Figure 10.24 (a) shows a thin liquid film supporting a small weight = 4.5×10^{-2} N. What is the weight supported by a film of the same liquid at the same temperature in Fig. (b) and (c) ? Explain your answer physically:



(a)



(b)



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58. What is the pressure inside the drop of mercury of radius 3.00 mm at room temperature ? Surface tension of mercury at that temperature ($20^{\circ} C$) is $4.65 \times 10^{-1} Nm^{-1}$The atmospheric pressure is $1.01 \times 10^5 Pa$. Also give the excess pressure inside the drop.

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59. What is the excess pressure inside a bubble of soap solution of radius 5.00 mm,given that the surface tension of soap solution at the temperature (20^@C) is 2.50xx 10 2 N in 1 ? If an air bubble of the same dimension were formed at depth of 40.0 cm inside a container containing the soap solution (of relative density 1.20), what would be the pressure inside the bubble ? (1 atmospheric pressure is 1.01xx 105 Pa).

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60. A tank with a square base of area 1.0 m^2 is divided by a vertical partition in the middle. The bottom of the partition has a small-hinged door of area $20cm^2$. The tank is filled with water in one compartment, and an acid (of relative density 1.7) in the other, both to a height of 4.0 m. compute the force necessary to keep the door close.

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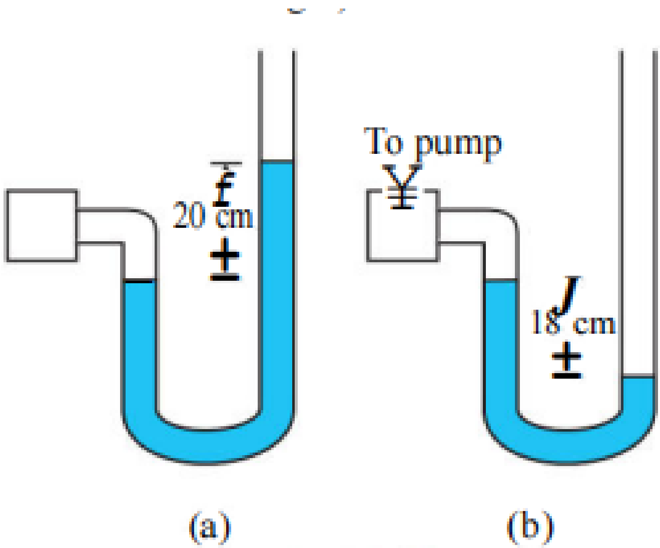
61. A manometer reads the pressure of a gasin an enclosure asshown in Fig. 10.25 (a) When a pump removes some of the gas, the manometer reads as in Fig. 10.25 (b) The liquid used in the manometersis mercury and the atmospheric pressure is 76 cm of mercury.Give the absolute and gauge pressure of the gas in the enclosure for cases (a) and (b), in units of cm of mercury.:



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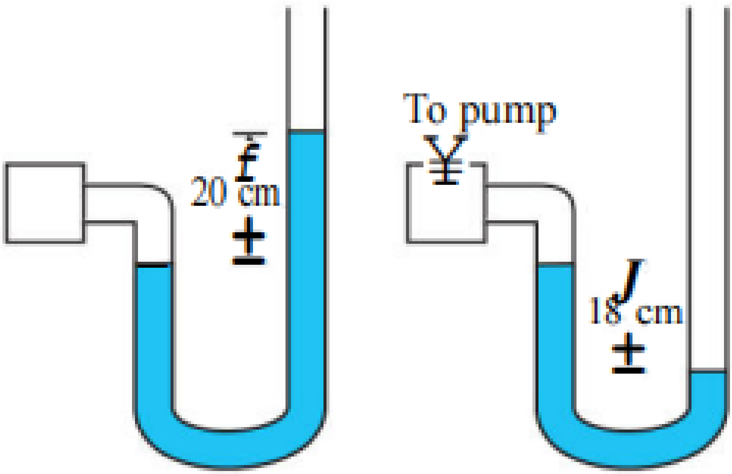
62. A manometer reads the pressure of a gasin an enclosure asshown in Fig. 10.25 (a) When a pump removes some of the gas, the manometer reads as in Fig. 10.25 (b) The liquid used in the manometersis mercury and the atmospheric pressure is 76 cm of mercury.How would the levels change in case (b) if 13.6 cm of water (immiscible with mercury) are poured into the right limb of the manometer ? (Ignore the small change in the volume of the gas).:



(a) (b)

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63. Two vessels have the same base area but different shapes. the first vessel takes twice the volume of water than the second, vessel requires to fill upto a particular common height. Is the force exerted by water on the base of the vessel the same in the two cases? If so, why do the vessel filled with water to that same height give differnt readings on a weighing scale?

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65. During blood transfusion the needle isinserted in a vein where the gauge pressure is 2000 Pa. At what height must the blood container be placed so that blood may just enter the vein ? [Use the density of whole blood from Table 10.1],

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66. In deriving Bernoulli's equation, we equated the work done on the fluid in the tube to its change in the potential and kinetic energy. Do the dissipative forces become more important asthe fluid velocity increases ? Discuss qualitatively.

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68. (a) What is the largest average velocity of blood flow in an artery of radius 2×10^{-3} m if the flow must remain laminar? (b) What is the corresponding flow rate? (Taking viscosity of blood to be $2.084 \times 10^{-3} Pas$)

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69. (a) What is the largest average velocity of blood flow in an artery of radius 2×10^{-3} m if the flow must remain laminar? (b) What is the corresponding flow rate? (Taking viscosity of blood to be $2.084 \times 10^{-3} Pas$)

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70. A plane is in level flight at constant speed and each of its two wings has an area of $25m^2$. If the speed of the air is $180km/h$ over the lower wing and $234 km / h$ over the upper wing surface, determine the plane's mass. (Take air density to be $1 kgm^{-3}$)

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71. In Millikan's oil drop experiment, what is the terminal speed of an uncharged drop of radius 2.0×10^5 m and density $1.2 \times 10^3 kgm^{-3}$. Take the viscosity of air at the temperature of the experiment to be 1.8×10^{-5} Pa s. How much is the viscous force on the drop at that speed ? Neglect buoyancy of the drop due to air

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72. Mercury has an angle of contact equal to 140° with soda lime glass. A narrow tube of radius 1.00 mm made of this glass is dipped in a trough containing mercury. By what amount does the mercury dip down in the tube relative to the liquid surface outside ? Surface tension of mercury at the temperature of the experiment is 0.465 Nm^{-1}. Density of mercury = $13.6 \times 10^3 kgm^{-3}$.

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73. Two narrow bores of diameters 3.0 mm and 6.0 mm are joined together to form a U-tube open at both ends. If the U-tube contains water, what is the difference in its levels in the two limbs of the tube ? Surface tension of water at the temperature of the experiment is $7.3 \times 10^{-2} Nm^{-1}'. Take the \angle of contact \rightarrow be zero$ and $density of water -$ 1.0xx 10^3 kg m^- 3(g = 9.8 m s^-2`) .

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74. It is known that density ρ of air decreases with height y (in metres) as :

$\rho = \rho_0 e^{-y/y_0}$ where $\rho_0 = 1.25 kgm^{-3}$ is the density at sea level and y_0 is a constant. This density variation is called the law of atmospheres. Obtain this law assuming the temperature of atomoshpere remains constant (isothermal conditions). Also assume that the value of g remains constant.

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75. A large ballon of volume $1425m^3$ is used to lift a payload of 400 kg. Assuming that the ballon maintains constant radius as it rises. How high does it rise? $(Take Y_0 = 8000m$ and $\rho_{He} = 0.18kgm^{-3})$

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76. The triple points of neon and carbon dioxide are $24.57k$ and $216.55K$ respectivley. Express these temperatures on the Celsius and Fahrenheit scales.

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77. Two absolute scals A and B have triple points of water defined to be 200 A and 350 B. What is the relation between T_A and T_B?

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78. The electrical resistance in ohms of any specimen of material varies with temperature according to the approximate law.

$R - R_0\left[1 + 5 \times 10^{-3}(T - T_0)\right]$ The resistance is 101.6Ω at triple point of water and 165.5 at normal meting point of head (600.5K). What is the temperature when the resistance is 123.4Ω?

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79. What is wrong in taking the melting point of ice and the boiling point of water as standard fixed point?(as was originally done in Celsius scale)

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80. Answer the following

There were two fixed points in the original celsius scale as mentioned above which were assigned the number $0^\circ C$ and $100^\circ C$ respectively. On the absolute scale, one of the fixed points is the triple point of water which on the kelvin absolute scale is assigned the number 273.16 K. What is the other fixed point on this (kelvin) scale?

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81. Answer the following

The absolute temperature (kelvin scale) T is related to the temperature T_C on the celsius scale by $T_C = T - 273.15$. Why do we have 273.15 in this relation and not 273.16?

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82. Answer the following

What is the temperature of the triple point of water on an absolute scalw whose unit interval size is equal to that of the Fahrenheit scale?

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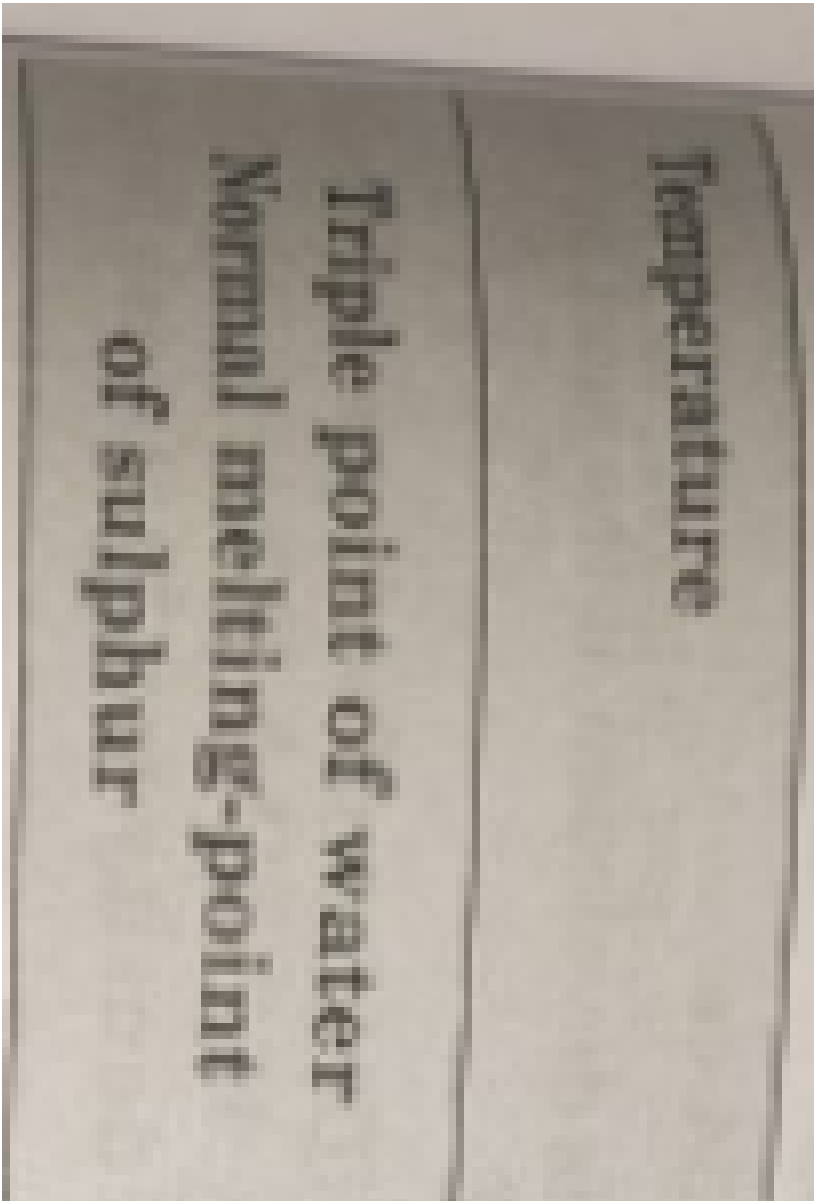
83. Two ideal gas thermometers A and B use oxygen and hydrogen respectively. The following observation are made: What further procedure is needed in the experiment to reduce the discrepancy between the two readings?



Temperature
Triple point of water
Normal melting point of sulphur

	Pressure Thermometer A	
	$1{\cdot}250 \times 10^5$ Pa $1{\cdot}757 \times 10^5$ Pa	

vations are made :

Pressure Thermometer B
$0{\cdot}200 \times 10^5$ Pa
$0{\cdot}287 \times 10^5$ Pa.

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84. A steel tape 1 metre long is correctly calibrated for temperature of $27.0^{\circ} C$. The length of a steel rod measured by this tape is found to be 63.0 cm on a h ot day when the temperature is $45^{\circ} C$. What is the actual length of the steel rod on that day? What is the length of the same steel rod on a day when the temperature is $27.0^{\circ} C$? Coefficient of linear expansion of steel $= 1.20 \times 10^{-5} C^{-1}$.

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85. A large steel wheel is to be fitted on a shaft of the same material . At $27^{\circ} C$, the outer diameter of the shaft is 8.70 cm and the diameter of the central hole in the wheel is 8.69 cm. The shaft is cooled using 'dry ice'. At what temperature of the shaft does the wheel slip on the shaft? Assume coefficient of linear expansion of the steel is to be constant over the required temperature range : $\alpha_{steel} = 1.20 \times 10^{-5} K$.

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86. A hole is drilled in a copper sheet. The diameter of the hole is 4.24 cm at $27^\circ C$. What is the change in the diameter of the hole when the sheet is heated to $227^\circ C$? Coefficient of linear expansion of copper $= 1.70 \times 10^5 \hat{} \circ C^{-1}$.

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87. A brass wire 1.8 m long at $27^\circ C$ is held when taut with little tension between two rigid supports. If the wire is cooled to a temperature - $39^\circ C$, what is the tension developed in the wire, if tis diameter is 2.0 mm? Coefficient of linar expansion of brass $= 2.0 \times 10^5 \hat{} \circ C^{-1}$, Young's modulus of brass $= 0.91 \times 10^{11} Pa$.

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88. A brass rod of length 50 cm and diameter 3.00 mm is joined to a steel rod of the same length and diameter. What is the change in length of the combined rod at $250^{\circ} C$, if the original lengths are at $40.0^{\circ} C$? Is there a 'thermal stress' developed at the junction? The ends of the rod are free to expand coefficent of linear expansion of brass $= 2.0 \times 10^{-5} \hat{} \circ C^{-1}$, steel $= 1.2 \times 10^{-5} \hat{} \circ C^{-1}$).

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89. The coefficient of volume expansion of glycerine is $49 \times 10^{-5} \hat{} \circ C^{-1}$. What is the fractional change in its density for $30^{\circ} C$ rise in temperature?

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90. A 10 kW drilling machine is used to drill a bore in a small aluminium block of mass 8.0 kg. How much is the rise in temperature of the block in 2.5 minutes, assuming 50% of power is used up in heating the machine itself or lost to the surroundings. Specific heat of aluminium $= 0.91 J g^{-1} \hat{} \circ C^{-1}$

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91. A coper block of mass 2.5 kg is heated in a furnace to a temperature of $500^{\circ} C$ and then placed on a large ice block. What is the maximum amount of ice that can melt? (specific heat of copper $= 0.39 J g^{-1} C^{-1}$, heat of fusion of watter =$335 J g^{-1}$).

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92. In a experiment on the specific heat of a metal, a 0.20 kg block of the metal at $150^{\circ} C$ is dropped in a copper calorimeter (of water equivalent 0.025 kg) containing 150 cc of water at $27^{\circ} C$. The final temperature is $40^{\circ} C$. Compute the specific heat of the metal. If heat losses to the surroundings are not negligible, is your answer greater or smaller than the actual value for specific heat of the metal?

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93. Given below are observations on molar specific heats at room temperature of some common gases The measured molar specific heats of these gases are markedly different from those for monatomic gases. Typically, molar specific heat of a monatomic gas is $2.92ca\frac{l}{m}olK$. Explain this difference. What can you infer from the somewhat larger (than the rest) value for chlorine ?

GAS	MOLAR SPECIFIC HEAT (C_v) cal mol^{-1} K^{-1}
Hydrogen	4.87
Nitrogen	4.97
Oxygen	5.02
Nitric oxide	4.99
Carbon monoxide	5.01
Chlorine	6.17

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94. Answer the following questions based on the P-T phase diagram of carbon dioxide:

At what temperature and pressure can the solid, liquid and vapour phases of CO_2 co-exist in equilibrium?

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95. Answer the following questions based on the P-T phase diagram of carbon dioxide:

What is the efect of decrease of pressure on the fusion and boiling point of CO_2?

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96. Answer the following questions based on the P-T phase diagram of carbon dioxide:

What are the critical temperature and pressure for $CO_{\circ}$? What is their significance?

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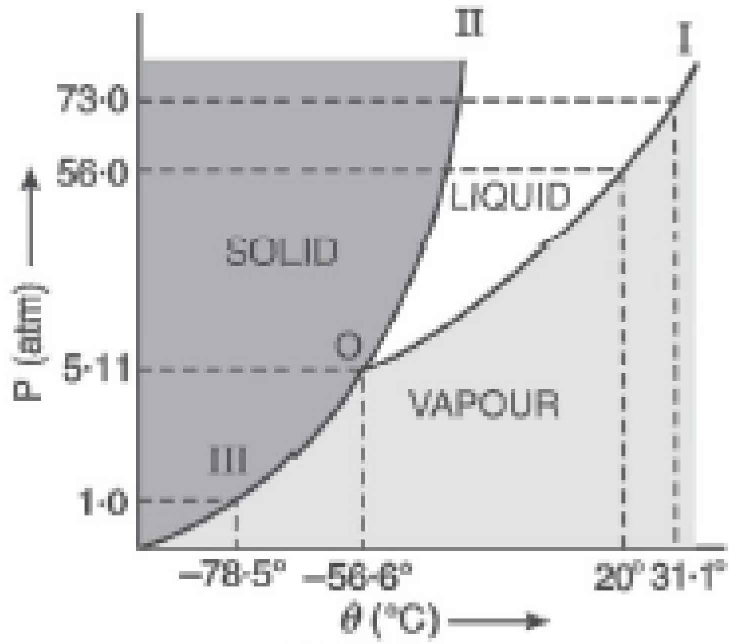
97. Answer the following questions based on the p-T phase diagram of carbon dioxide as shown in the figure . Is $C0_2$ solid , liquid, or gas at (a)

$-70^{\circ} C$ under 1 atm?



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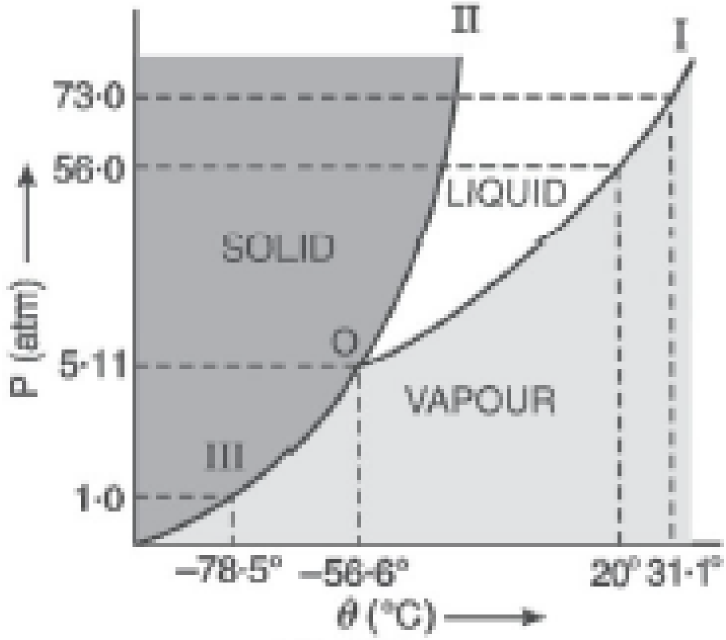
98. Answer the following questions based on the p-T phase diagram of carbon dioxide as shown in the figure . Is $C0_2$ solid , liquid, or gas at

$-60^{\circ}C$ under 10 atm?



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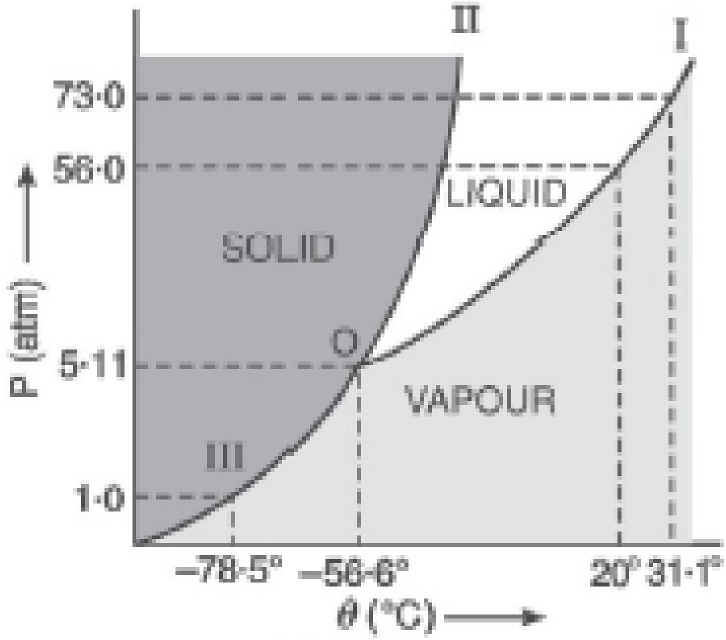
99. Answer the following questions based on the p-T phase diagram of carbon dioxide as shown in the figure . Is $C0_2$ solid , liquid, or gas at

$15^\circ C$ under 56 atm ?



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100. Answer the following questions based on the P-T phase diagram of CO_2

CO_2 at 1 atm pressure and temperature $60^\circ C$ is compressed isothermally. Does it go through a liquid phase?

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101. Answer the following questions based on the P-T phase diagram of CO_2

What happens when CO_2 at 4 atm pressure is cooled from room temperature at constnat pressure?

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102. Answer the following questions based on the P-T phase diagram of CO_2

Describe qualitatively the changes in a given mass of solid CO_2 at 10 atm pressure and temperature $-65^\circ C$ as it is heated upto room temperature at constant pressure.

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103. A child running a temperature of $101^\circ F$ is given an antipyrin (i.e. a medicine that lowers fever) which causes an increase in the rate of evaporation of sweat from his body. If the fever is brought down to $98^\circ F$

in 20 min., What is the average rate of extra evaporation caused by the drug ? Assume the evaporation mechanism to be the only way by which heat is lost. The mass of the child is 30 kg. The specifric heat of human body is approximately the same as that of water, and latent heat of evaporation of water at that temperature is aout $580 cal g^{-1}$.

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104. A thermocole box is a cheap and effieicnet method for storing small quantity of cooked food in summer in particular. A cubical box of side 30 cm has a thickness of 5 cm. If 4 kg of ice are put in a box. Estimate the amount of ice remaining after 6 h. The outside temperature $45^{\circ} C$, and coefficient $K = 0.01 J s^{-1} m^{-1} k^{-1}$ [Heat of fusion of water $= 335 \times 10^{3} J kg^{-1}$].

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105. A brass boiler has a base area of $0.15 m^{2}$ and thickness 1.0 cm. It boils water at the rate of 6.0 kg/min. When placed on a gas stove. Estimate the temperature of the part of the flame in contact with boiler. Thermal conductivity of brass $= 109 js^{-1} m^{-1} \hat{\ } \circ C^{-1}$.

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106. Explain why:

A body with large reflecting is a poor emitter.

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107. Explain why:

A brass tumbler feels much colder than a wooden tray on a chilly day.

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108. Explain why:

An optical pyrometer (for measuring high temperature) calibrated for an ideal black body radiation gives too low value for the temperature of a red hot iron piece in the open, but gives a correct value for the temperature when the same piece is in the furnace.

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109. Explain why:

The earth without its atmosphere would be in hospitably cold.

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110. Explain why:

Heating systems based on circulation of steam are more efficient in warming a building than those based on circulation of hot water.

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111. A body cools from $80^\circ C$ to $50^\circ C$ in 5 minuts. Calculate the time it takes to cool from $60^\circ C$ to $30^\circ C$. The temperature of surrounding is

$20^{\circ} C.$

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112. A wire elongates by l mm when a load W is hanged from it. If the wire goes over a pulley and two weights W each are hung at the two ends, the elongation of the wire will be (in mm)

A. 0

B. $l/2$

C. l

D. 2l

Answer:

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113. Two wires are made of the same material and have the same volume. However wire 1 has cross-sectional area A and wire 2 has cross-sectional area 3A. If the length of wire 1 increases by Δx on applying force F, how much force is needed to stretch wire 2 by the same amount?

A. F

B. 4F

C. 6F

D. 9F

Answer:

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114. If S is stress and Y is Young's modulus of material of a wire, find the energy stored in the wire per unit volume in terms of S and Y.

A. $2S^2Y$

B. `S^2/(2Y)

C. $2Y / S^2$

D. $S / 2Y$

Answer:

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115. A wire fixed at the upper end stretches by length l by applying a force F. The work done in stretching is

A. 2Fl

B. Fl

C. $F / 2l$

D. $Fl / 2$

Answer:

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116. A wire suspended vertically from one of its ends is stretched by attaching a weight of 200 N to the lower end. The weight stretches the wire by 1 mm. Find the elastic energy stored in the wire.

A. 0.2J

B. 0.1J

C. 20J

D. 10J

Answer:

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117. Spherical balls of radius 'R' are falling in a viscous fluid of viscosity η with a velocity v. The retarding viscous force acting on the spherical ball is

A. directly proportional to R but inversely proportional to v

B. directly proporbanal to both radius R and velocity v.

C. inversly proportional to both radius R and velocity v.

D. inversly proportional to R but directly proportional to velocity v

Answer:

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118. If the terminal speed of a sphere of gold (density $=19.5kg/m^3$) is $0.2m/s$ in a viscous liquid (density $=1.5kg/m^3$), find the terminal speed of a sphere of silver (density $=10.5kg/m^3$) of the same size in the same liquid

A. $0.1m/s$

B. $0.133m/s$

C. $0.2m/s$

D. $0.4m/s$

Answer:

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119. Water is flowing continuously from a tap having an internal diameter $8 \times 10^{-3}m$. The water velocity as it leaves the tap is $0.4ms^{-1}$. The diameter of the water stream at a distance 2×10^{-1}m below the tap is close to:

A. 5×10^{3} m

B. 7.5×10^{3} m

C. 3.6×10^{3} m

D. 9.6×10^{3} m

Answer:

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120. A cylinder of height 20 m is completely or filled with water. Find the velocity of efflux of water (in m s^-1) through a small hole on the side wall of the cylinder near its bottom. Given, g = $10ms^{-2}$

A. 5

B. 10

C. 20

D. 25.5

Answer:

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121. A 20 cm long capillary tube is dipped in water. the water rises up to 8 cm. if then there arrangement is put in a freely falling elevator, what will be the length of water column in the capillary tube?

A. 4cm

B. 8cm

C. 10cm

D. 20cm

Answer:

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122. If two soap bubbles of different radii are connected by a tube

A. air flows from the bigger bubble to the smaller bubble till the sizes become equal

B. air flows from bigger bubble to the smaller bubble till the sites are interchanged

C. air flows from the smaller bubble to the bigger

D. there is no flow of air

Answer:

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123. Work done in increasing the size of a soap bubble from a radius of 3cm to 5cm is nearly (Surface tension of soap solution =$0.03Nm^{-1}$)

A. 2mJ

B. 0.2mJ

C. 4mJ

D. 0.4mJ

Answer:

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124. The heat required to raise the temperature of a body by 1C degree is called

A. water equivalent

B. temperature gradient

C. specific heat

D. thermal capacity

Answer:

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125. The temperature of the two outer surfaces of a composite slab, consisting of two materails having coefficients of two materails having coefficients of termal conductivity K and 2K and thickness x and 4x, respectively, are T_2 and $T_1(T_2 > T_1)$. The rate of heat transfer through the slab, in a steady state is $\left(\frac{A(T_2 - T_1)K}{x}\right)f$, with f equal to

A. 1

B. $1/2$

C. $2/3$

D. $\frac{1}{3}$

Answer:

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126. One end of a thermally insulated rod is kept at a temperature T_1 and the other at T_2. The rod is composed of two sections of length l_1 and l_2 and thermal conductivities K_1 and K_2 respectively. The temperature at the interface of the two section is

A. $\frac{(K_2L_2T_1) + (K_1L_1T_2)}{(K_1L_1) + (K_2L_2)}$

B.

C.

D.

Answer:

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127. Which of the following is more close to black body?

A. Blackboard paint

B. Green leaves

C. Red roses

D. black holes

Answer:

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128. The earth radiates in the infra-red region of the spectrum. The spectrum is correctly given by

A. (A) Planck's law of radiation

B. (B) Stefan's law of radiation

C. (C) Rayleigh Jeans law

D. (D) Wien's law

Answer:

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129. If the temperature of the sun were to increase from T to 2T and its radius from R to 2R, then the ratio of the radiant energy received on earth to what it was previously, will be

A. 4

B. 16

C. 32

D. 64

Answer:

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130. Two spheres of the same material have radii 1m and 4m and temperature 4000K and 2000K respectively. The ratio of energy radiated per second by the first sphere to that by the second is

A. $1:1$

B. $1:9$

C. $4:1$

D. $16:1$

Answer:

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