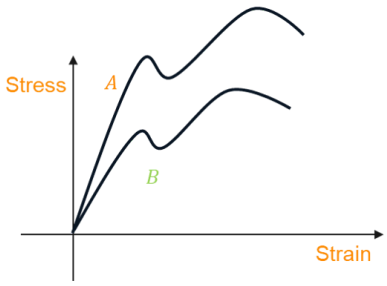
JEE Main Part Test 2

Subject: Physics

Class: Standard XII

1. The stress-strain diagram for two materials A and B are shown here. Select the correct option.



A. 'A' has greater Young's modulus than 'B'

B. 'B' has greater Young's modulus than 'A'

C. 'A' & 'B' has same Young's modulus

D. Cannot comment

2. A brass rod of length $1\ \mathrm{m}$ is fixed to a vertical wall at one end, with the other end kept free to expand. When the temperature of the rod increases by $120^{\circ}\mathrm{C}$, the length increases by $3\ \mathrm{cm}$. What is the strain?

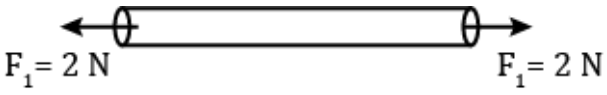
A. 0.5

B. 0.005

C. 0.05

D. 0

3. Stress generated in a wire when force F_1 acts on it as shown in the figure, is T. Initial cross sectional area of the wire is A_1. When force F_2 replaces F_1, cross-sectional area becomes A_2. Find $\left(\frac{A_2}{A_1}\right)$ if $F_2 = 6\ \text{N}$.
[Consider stress generated in the wire to be the same]



A. 3

B. $1/2$

C. 4

D. $1/6$

4. Two cylindrical wires A and B are of the same material. Their lengths are in the ratio $1:2$ and the diameters are in the ratio $2:1$. If they are pulled by the same force, then increase in their respective lengths will be in the ratio

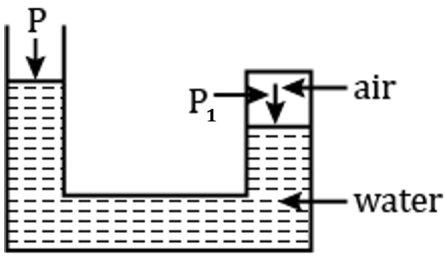
A. $2:1$

B. $1:4$

C. $1:8$

D. $8:1$

5. The pressure of the confined air in the right leg is P_1. If the atmospheric pressure is P, then



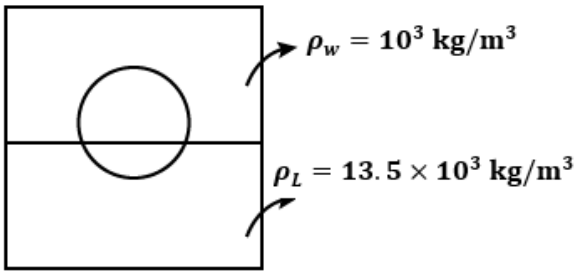
A. P is equal to P_1

B. P is less than P_1

C. P is greater than P_1

D. P may be less or greater than P_1 depending on the mass of the confined air

6. A metallic sphere floats in an immiscible mixture of water and a liquid such that its $\frac{4}{5}$th volume is in water and $\frac{1}{5}$th volume is in the liquid. Then, density of the metal is



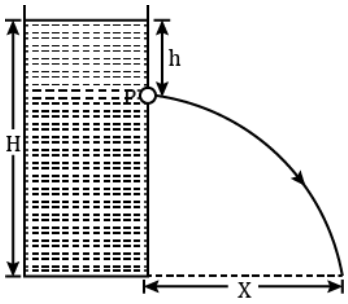
A. $3.5 \times 10^3\ \mathrm{kg/m^3}$

B. $1.5 \times 10^3\ \mathrm{kg/m^3}$

C. $4 \times 10^3\ \mathrm{kg/m^3}$

D. $2 \times 10^3\ \mathrm{kg/m^3}$

7. A tank is filled with water upto a height H. Water is allowed to come out of a hole P in one of the walls at a depth h below the surface of water (see figure). Express the horizontal distance X in terms of H and h.



A. $X = \sqrt{h(H-h)}$

B. $X = \sqrt{\frac{h}{2}(H-h)}$

C. $X = 2\sqrt{h(H-h)}$

D. $X = 4\sqrt{h(H-h)}$

8. If the excess pressure inside a soap bubble of radius $1\ \text{cm}$ is balanced by an oil
($\rho = 0.8\ \text{g/cm}^3$) column of height $2\ \text{mm}$, then the surface tension of soap solution will be
[Take $g = 10\ \text{m/s}^2$]

A. $0.02\ \text{N/m}$

B. $0.04\ \text{N/m}$

C. $0.09\ \text{N/m}$

D. $0.08\ \text{N/m}$

9. Water rises to a height h in a capillary tube of area of cross-section a. To what height will the water rise in a capillary tube of area of cross-section $4a$?

A. $\frac{h}{4}$

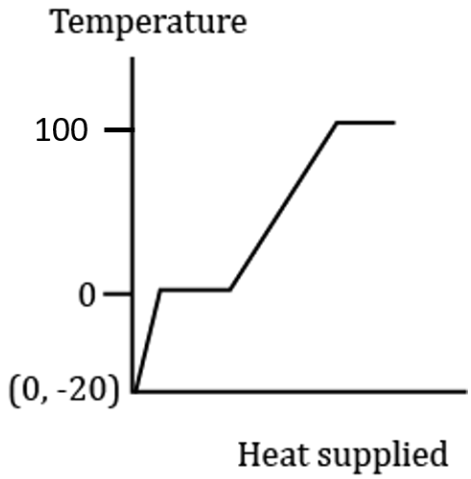
B. $\frac{h}{2}$

C. $2h$

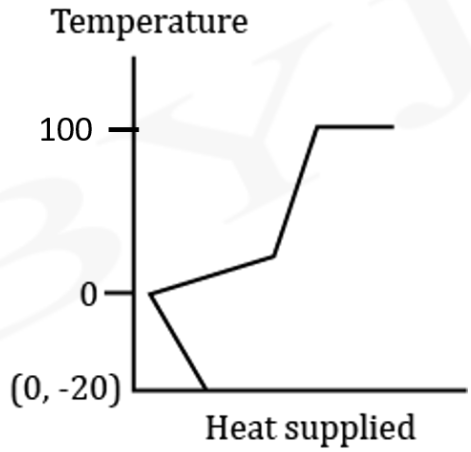
D. $4h$

10. A block of ice at temperature $-20^{\circ}\mathrm{C}$ is slowly heated and converted to steam at $100^{\circ}\mathrm{C}$. Which of the following diagrams is most appropriate?

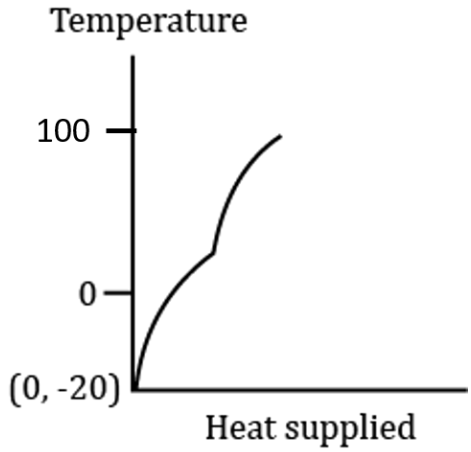
A.



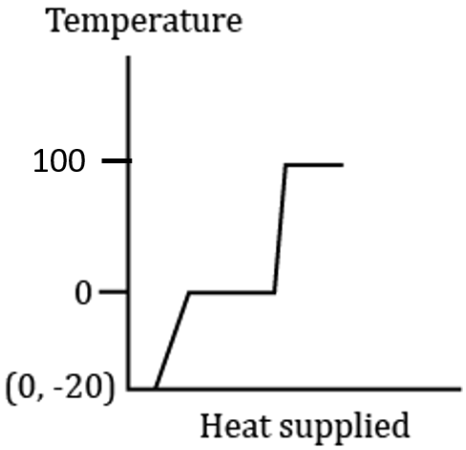
B.



C.



D.



11. A hole is drilled in a copper sheet. The diameter of the hole is $4.24\ \mathrm{cm}$ at $27\ ^{\circ}\mathrm{C}$. What is the change in the diameter of the hole when the sheet is heated to $227\ ^{\circ}\mathrm{C}$?
$[\ \alpha = 1.70 \times 10^{-5} / \ ^{\circ}\mathrm{C}\ ]$.

A. $1.44 \times 10^{-2}\ \mathrm{cm}$

B. $1.96 \times 10^{-2}\ \mathrm{cm}$

C. $1.78 \times 10^{-2}\ \mathrm{cm}$

D. $1.28 \times 10^{-2}\ \mathrm{cm}$

12. A uniform copper rod of length $50\ \mathrm{cm}$ and diameter $3\ \mathrm{mm}$ is kept on a frictionless horizontal surface at $20\ ^{\circ}\mathrm{C}$. The coefficient of linear expansion of copper is $2 \times 10^{-5}\ ^{\circ}\mathrm{C}^{-1}$ and Young's modulus is $1.2 \times 10^{11}\ \mathrm{N/m^2}$. The copper rod is heated to $100\ ^{\circ}\mathrm{C}$, Then, the tension developed in the copper rod is

A. $12 \times 10^{3}\ \mathrm{N}$

B. $36 \times 10^{3}\ \mathrm{N}$

C. $18 \times 10^{3}\ \mathrm{N}$

D. Zero

13. The root mean square speed of a gas molecule is $300\ \mathrm{m/s}$. What will be the root mean square speed of the molecules if the atomic mass is doubled and absolute temperature is halved?

A. $300\ \mathrm{m/s}$

B. $150\ \mathrm{m/s}$

C. $600\ \mathrm{m/s}$

D. $175\ \mathrm{m/s}$

14. The temperature of a gas at pressure P and volume V is $27^{\circ}\mathrm{C}$. Keeping its volume constant, if its temperature is raised to $927^{\circ}\mathrm{C}$, then its pressure will be -

A. $2P$

B. $3P$

C. $4P$

D. $6P$

15. A perfect gas goes from a state A to state B by absorbing $8 \times 10^5\ \mathrm{J}$ and by doing $6.5 \times 10^5\ \mathrm{J}$ of external work. It is taken from same initial state A to final state B in another process in which it absorbs $10^5\ \mathrm{J}$ of heat, then work done in the second process

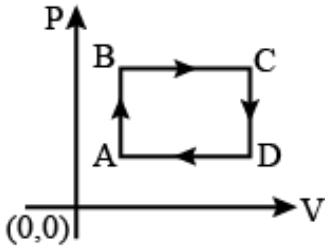
A. on gas is $10^5\ \mathrm{J}$

B. on gas is $0.5 \times 10^5\ \mathrm{J}$

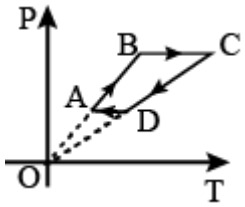
C. by gas is $10^5\ \mathrm{J}$

D. by gas is $0.5 \times 10^5\ \mathrm{J}$

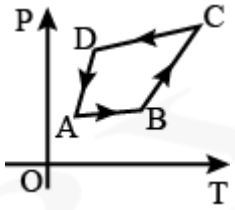
16. The figure shows the $P-V$ diagram of a thermodynamic cycle for an ideal gas. Which of the following graphs for the corresponding $P-T$ diagram is correct ?



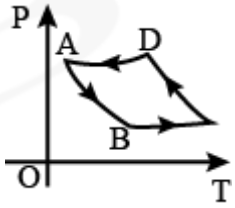
A.



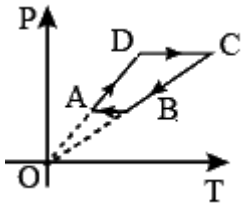
B.



C.



D.



17. A thermodynamic cycle is comprised of four processes $1 \rightarrow 2$, $2 \rightarrow 3$, $3 \rightarrow 4$ and $4 \rightarrow 1$. Heat & work interactions of these processes are given as

Process	Heat transfer (J)	Work done (J)
1-2	0	150 (by the gas)
2-3	100 (from the gas)	0
3-4	0	50 (on the gas)
4-1	200 (to the gas)	0

The thermal efficiency of the cycle is -

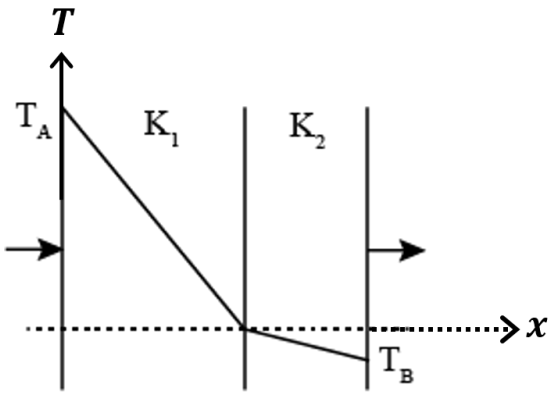
A. $20\ \%$

B. $30\ \%$

C. $40\ \%$

D. $50\ \%$

18. Temperature variation under steady state heat conduction across a composite slab of two materials with thermal conductivities K_1 and K_2 having same cross sectional area is shown in figure. Choose the correct statement.



A. $K_1 > K_2$

B. $K_1 = K_2$

C. $K_1 = 0$

D. $K_1 < K_2$

19. Two spheres A and B having radii $3\ \text{cm}$ and $5\ \text{cm}$ respectively are coated with carbon black on their outer surface. The wavelengths of maximum intensity of emission of radiation are $300\ \text{nm}$ and $500\ \text{nm}$ respectively. The respective powers radiated by them are in the ratio of :

A. $\sqrt{\frac{5}{3}}$

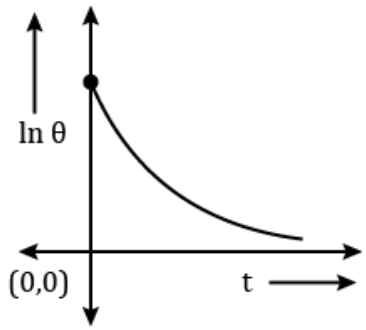
B. $\frac{5}{3}$

C. $\left(\frac{5}{3}\right)^2$

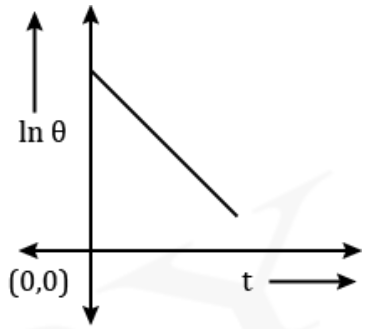
D. $\left(\frac{5}{3}\right)^4$

20. Instantaneous temperature difference between a cooling body and the surroundings, obeying Newton's law of cooling, is θ. Which of the following represents the variation of ln θ with time t?

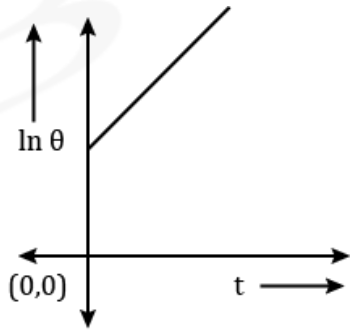
A.



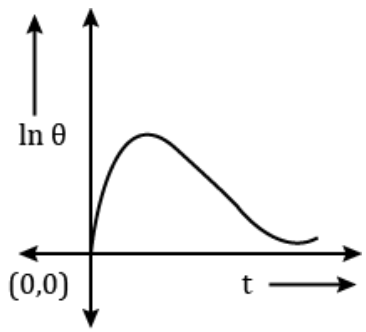
B.



C.



D.



21. A particle executes SHM with a time period of $4\ \text{s}$. Find the time taken by the particle to go directly from its mean position to half of its amplitude.

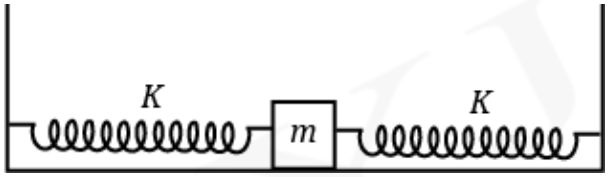
A. $\frac{1}{6}\text{s}$

B. $\frac{1}{3}\text{s}$

C. $\frac{1}{2}\text{s}$

D. $\frac{2}{5}\text{s}$

22. In the given figure, the block is displaced slightly and released. Then, the time period of oscillation is:



A. $T = 2\pi\sqrt{\frac{2m}{K}}$

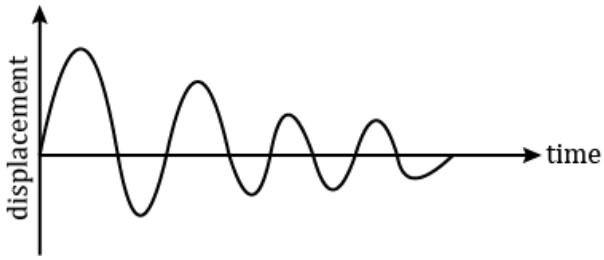
B. $T = 2\pi\sqrt{\frac{m}{K}}$

C. $T = 2\pi\sqrt{\frac{m}{2K}}$

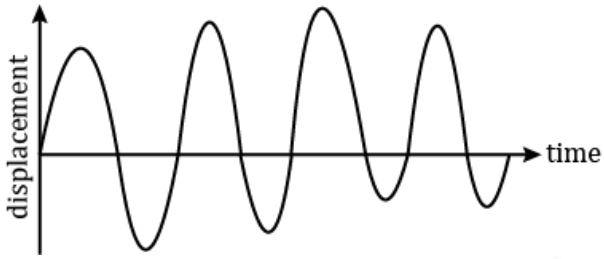
D. $T = 2\pi\sqrt{\frac{m}{3K}}$

23. Which of the following figures represents damped harmonic motion?

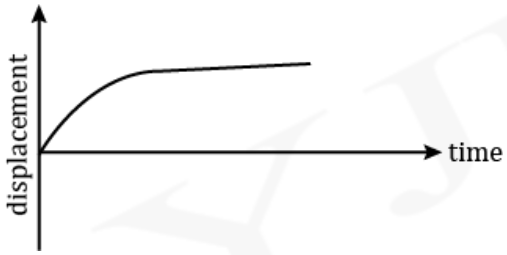
A.



B.

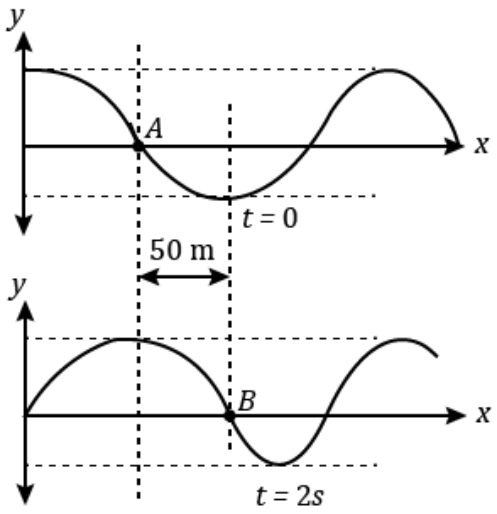


C.



D.

24. Find the phase velocity of the wave whose $y - x$ graph is shown at two instants.



A. $10\ \mathrm{m/s}$

B. $15\ \mathrm{m/s}$

C. $25\ \mathrm{m/s}$

D. $20\ \mathrm{m/s}$

25. Choose the correct option for the given assertion and reason.

Assertion : When a wave travels from a denser medium to rarer medium, its amplitude of oscillation increases.

Reason : In denser medium, speed of wave is less compared to that in rarer medium.

A. Assertion and Reason both are true and the Reason is correct explanation of the Assertion.

B. Assertion and Reason both are true, but Reason is not the correct explantion of Assertion.

C. Assertion is true, but Reason is false

D. Assertion is false, but Reason is true.

26. A $1\ \mathrm{m}$ long horizontal rope, having a mass of $40\ \mathrm{g}$, is fixed at one end and is tied to a light string at the other end. The tension in the rope is $400\ \mathrm{N}$. What will be the wavelengths (in metres) in the first and second overtone ?

A. $\frac{3}{4}, \frac{3}{4}$

B. $\frac{4}{3}, \frac{4}{5}$

C. $\frac{5}{4}, \frac{5}{3}$

D. $\frac{4}{5}, \frac{4}{3}$

27. Rahul is playing the drums. An increase in which of the following properties of the sound produced would result in an increase in loudness?

A. Amplitude

B. Speed

C. Pitch

D. Quality

28. The first overtone frequency of a closed organ pipe P_1 is equal to the fundamental frequency of an open organ pipe P_2. If the length of the pipe P_1 is $60\ \mathrm{cm}$, what will be the length of P_2?

A. $20\ \mathrm{cm}$

B. $40\ \mathrm{cm}$

C. $60\ \mathrm{cm}$

D. $80\ \mathrm{cm}$

29. A tuning fork vibrating at frequency $1000\ \mathrm{Hz}$ produces resonance in a resonance column tube. The upper end is open and the lower end is closed by the water whose height can be varied. The successive resonances are observed at lengths $10\ \mathrm{cm}$ and $27\ \mathrm{cm}$. Then, the speed of sound in air is [neglect end corrections]

A. $340\ \mathrm{m/s}$

B. $330\ \mathrm{m/s}$

C. $343\ \mathrm{m/s}$

D. $353\ \mathrm{m/s}$

30. A train moves towards a stationary observer with a speed $34\ \mathrm{m/s}$. The train sounds a whistle and its frequency registered by the observer is f_1. If the speed of the train is reduced to $17\ \mathrm{m/s}$, the frequency registered is f_2. If the speed of sound is $340\ \mathrm{m/s}$, then the ratio $\frac{f_1}{f_2}$ is

[Assume, medium is stationary]

A. $\frac{18}{19}$

B. $\frac{1}{2}$

C. 2

D. $\frac{19}{18}$