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## PHYSICS

## BOOKS - CBSE COMPLEMENTARY MATERIAL PHYSICS (HINGLISH)

## MECHANICAL WAVES

## One Mark Questions

1. Time period of simple pendulum increase
2. Define force constant of spring .

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3. A particle executes simple harmonic motion of ampliltude A. At what distance from the mean position is its kinetic energy equal to its potential energy?
4. How is the frequency of oscillation related with the frequency of change in the K.E. and P.E. of the body in S.H.M ?

## D View Text Solution

5. The frequency of total energy of a particle in

## SHM is

6. How is the length of seconds pendulum
related with acceleration due to gravity of any planet?

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7. If the bob of a simple pendulum is made to osciliate in some fluid of density greater than the density of air ( density of the bob > density of the fluid ), then time period of the pendulum increased or decrease.
8. How is the time period of the effected, when pendulum is taken to hills or in mines?

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9. A transverse wave travels along x-axis. The particles of medium move
10. Define angular frequency. Give its S.I. unit.

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11. Does the direction of acceleration at
various points during the oscillation of a simple pendulum remain towards mean positon?

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12. What is the time period for the function
$f(t)=\sin \omega t+\cos \omega t$ may represent the simple harmonic motion ?

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13. When will the motion of a simple pendulum
be simple harmonic?

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14. Can the motion of an artificial satellite around earth be taken as SHM?

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15. What is the phase relationship between diplacement, velocity and acceleration in SHM?

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16. What forces keep the simple pendulum in simple harmonic motion?

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17. How will the the time period of a simple pendulum change when its length is doubled ?

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18. What is a harmonic wave function ?

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19. If the motion of revolving particle is perodic in nature, give the nature of motion or projection of the revolving particle along the diameter.

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20. In forcd oscillation of a particle, the amplitude is maximum for a frequency $\omega_{1}$ of
the force, while the energy is maximum for a frequency $\omega_{2}$ of the force. What is the relation between $\omega_{1}$ and $\omega_{2}$ ?

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21. Which properties of a medium are responsible for propagation of wave through
it ?

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22. What is the nature of the thermal change
in air, when a sound wave propagates through
it ?

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23. Why does sound travel faster in iron than
in water or air?

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24. When will the motion of a simple pendulum be simple harmonic?

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25. A simple harmonic motion of acceleration
' $a$ ' and displacement ' $x$ ' is represented by
$a+4 \pi^{2} x=0$ What is the time period of S.H.M ?
26. What is the main difference between

## forced oscillations and resonance ?

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27. Define amplitude of $S . H . M$. ?

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28. What is the condition to be satisfied by a mathematical relation between time and
displacement to describe a periodic motion ?

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29. Why the pitch of the organ pip[e on a hot summer day is higher ?

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30. Under what conditions does a sudden
phase reversal of waves on reflection takes
place?
31. The speed of sound does not depend upon
its frequency. Give an example in support of this statement.

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32. An explosion takes place at the bottom of a
lake. Will the shock waves in the water be longitudinal or transverse?

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33. Which is most fundamental property of a wave?

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34. How does particle velocity differ from wave velocity?
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35. If any liquid of density of water is used in a resonance tube, how will the frequency change?

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36. Under what condition, te Doppler will not
be observed, if the source of sound moves towards the listener ?
37. What physical change occurs when a source of sound moves and listener is at rest?

## D Watch Video Solution

38. What physical change occurs when source of sound waves is at rest and the listener moves?

## D Watch Video Solution

39. If two sound waves of frequencies 480 Hz
and 536 Hz superpose, will they produce beats? Would you hear the beats?

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40. What is a non dispersive medium?

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## Two Mark Questions

1. Which of the following conditions is not sufficient for SHM and why?
(i) acceleration $\propto$ displacement,
(ii) restoring force $\propto$ displacement.

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2. The formula for time period $T$ for a loaded spring, $T=2 \pi$. Does the time period depend on lenght of the spring ?
3. Assertion: Water in a $U$-tube executes
$S H M$, the time period for mercury filled up to
the same height in the $U$-tube be greater then that in case of water.

Reason:The amplitude of an oscilliating pendulum goes on increasing.

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4. There are two springs, one delicate and another stiffer one. Which spring will have a
greater frequency of oscillation for a given

## load?

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5. Time period of a particle in S.H.M. Depends on the force constant $K$ and mass $m$ of the particle $T=2 \pi \sqrt{m} / k$. A simple pendulum for small angular displacement executes S.H.M. approximately. Why then is the time periodof a pendulum independent of the mass of the pendulum?
6. Answer the following questions:
(a) The motion of a simple pendulum is approximately simple harmonic for small angle oscillation. For larger angles of oscilliation, a more involved analysis shows that $T$ is greater
than $2 \pi \sqrt{\frac{t}{g}}$ Think of a qualitative argument to appreciate this result.
(b) What is the frequency of oscillation of a simple pendulum mounted in a cabin that is freely falling under gravity?
7. The maximum acceleration of a simple harmonic oscillator is $a_{0}$ and maximum velocity is $v_{0}$. What is the displacement amplitude?

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8. Velocity of sound in a tube containing air at $27^{\circ} \mathrm{C}$ and at a pressure of 76 cm of Hg is 300
$\mathrm{m} / \mathrm{s}$. What will its velocity be when the pressure is increased to 100 cm of Hg and the temperature is keptconstant ?

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9. Even after breakup of one prong of tunning
fork it produces a round of same frequency, then what is the use of having a tunning fork with two prongs ?
10. Why all the stringed instruments are provided with hollow boxes?

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11. The displacement of particle in S.H.M. May
be given by $y=a \sin (\omega t+\phi)$ show that if the
time $t$ is increased by $2 \pi / \omega$, the value of $y$ remains the same.

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12. The length of simple pendulum executing SHM is increased by21 \%. By what \% time period of pendulum increase?

## D Watch Video Solution

13. Define wave number and angular wave number and give their S.I. Units.

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14. Why does the sound travel faster in humid air?

## D View Text Solution

15. Use the formula $v=\sqrt{\frac{\gamma P}{\rho}}$ to explain why
the speed of sound in air
(a) is independent of pressure, (b) increases
with temperature, (c) increases with humidity.

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16. Differentiate between closed pipe and open pipe at both ends of same length fro frequency of fundamental note and harmonics.

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17. Bats can ascertain distances, directions, nature and size of the obstacle without any eye, explain how?
18. In a sound wave, a displacement node is a pressure antinode and vice-versa. Explain, why ?

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19. Does the frequency of a vibrating tuning fork change on increasing the temperature?
20. Why cannot we hear an echo in a small room?

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21. What do you mean by reverberation and reverberation time ? How is reverberation controlled ?

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Three Mark Questions

1. Show that for a particle in linear simple harmaonic motion, the acceleration is directly proportional to its displacement of the given instant.

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2. Show that for a particle in linear S.H.M., the average kinetic energy over a period of oscillation equals the average potential energy over the same period.
3. Deduce an expression for the velocity of a particle executing S.H.M. When is the particle velocity (i) Maximum (ii) minimum ?

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4. Draw (a) displacement time graph pf a particular executing SHM with phase angle $\phi$
equal to zero (b) velocity time graph and (c) acceleration time graph of the particle.

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5. Show that a linear combination of sine and
cosine function like $x(t)=a \sin \omega t+b \cos \omega t$
represents a simple harmonic. Also, determine
its amplitude and phase constant.

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6. Show that S.H.M the phase difference between displacement and velocity is $\frac{\pi}{2}$, and between displacement and acceleration is $\pi$.

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7. Show that for a small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression of its time period.
8. Distinguish clearly with an illustration between free, forced and resonant oscillations.

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9. In reference to a wave motion, define the terms (i) amplitude (ii) time period
frequency (iv) angular frequency (v) wave length and wave number.
10. What do you mean by phase of a wave ?
discuss the phase change with time and position.

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## Long Questions

1. If the pitch of the sound of a source appears
to drop by $10 \%$ to a moving person, then
determine the velocity of motion of the person. Velocity of sound $=300 \mathrm{~ms}^{-1}$.

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## Numericals

1. A particle is moving with SHM in a straight
line. When the distance of the particle from
the equilibrium position has values $x_{1}$ and $x_{2}$,
the corresponding value of velocities are $u_{1}$
and $x_{1}$. Show that the time period of oscillation is given by $t=2 \ldots$.

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2. Find the period of vibrating particle (SHM), which has acceleration of $45 \mathrm{cms}^{-2}$, when displacement from mean position is 5 cm .

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3. A 40 gm mass produces on extension of 4 cm in a vertical spring. A mass of 200 gm is suspended at its bottom and left pulling down. Calculate the frequency of its vibration.

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4. The acceleration due to gravity on the
surface of the moon is $1.7 \mathrm{~ms}^{-2}$. What is the
time perioid of a simple pendulum on the surface of the moon, if its time period on the
surface of earth is $3.5 s ?$ Take $g=9.8 m s^{-2}$ on the surface of the earth.

## D Watch Video Solution

5. A particle executes simple harmonic motion of amplitude A. (i) At what distance from the mean positio is its kinetic energy equal to its potential energy? (ii) At what points is its speed half the maximum speed?

## D Watch Video Solution

6. A set of 24 tuning fork is arranged in a series of increasing frequencies. If each fork gives 4 beats per second with the preceding one and the last sounds the ocatve of the first,
find the frequencies of the first and the last forks.

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7. The vertical motion of a huge piston in a
machine is approximately simple harmonic
with a frequency of $0.50 \mathrm{~s}^{-1}$. A block of 10 kg is
placed on the pistion. What is the maximum amplitude of the pistion's SHM for the block and the piston to remain together ?

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8. At what temperature will the speed of sound be double its value at 273 K ?

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9. A spring balance has a scale that reads from

0 to 50 kg . The length of the scale is 20 cm . A
body suspended from this spring, when displaced and released, oscillates with a period of 0.60 s . What is the weight of the body?

## D View Text Solution

10. If the pitch of the sound of a source appears to drop by $10 \%$ to a moving person,
then determine the velocity of motion of the person. Velocity of sound $=330 \mathrm{~ms}^{-1}$.

## D View Text Solution

11. A body of mass $m$ suspended from a spring executes SHM. Calculate ratio of K.E and P.E. Of body when it is at a displacement half of its amplitude from mean position.
12. A string of mass 2.50 kg is under a tension os 200 N . The length of the stretched string is
20.0m. If the transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end?

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13. Which of the following funchtions of time represent (a) periodic and (b) non-periodic motion? Give the period for each of period
motion. ( $\omega$ is any positive constant )
(i) $\sin \omega t+\cos \omega t$
(ii) $\sin \omega t+\cos 2 \omega t+\sin 4 \omega t$
(iii) $e^{-\omega t}$ (iv) $\log \omega t$

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14. The equation of a plane progressive wave is
give by equation
$y=10 \sin 2 \pi(t-0.005 x)$
where y and x are in cm and t is in seconds.

## Calculate the amplitude, frequency,

wavelength and velocity of the wave.

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15. A tuning fork arrangement (pair) produces
$4 b e a t s$ / sec with one fork of frequency $288 c p s$.

A little wax is placed on the unknown fork and
it then produces 2 beats $/ \mathrm{sec}$. The frequency of the unknown fork is
16. A pipe 20 cm long is closed at one end, which harmonic mode of the pipe is resonantly excited by a 430 Hz source? Will this same source can be in resonance with the pipe, if both ends are open? Speed of sound = $340 \mathrm{~ms}^{-1}$.

## - View Text Solution

17. The length of wire between the two ends of a sonometer is 105 cm . Where should the two bridges be placed so trhat the fundamental
frequencies of the three segments are in the ratio of 1:3:15 ?

## D View Text Solution

18. The transverse displacement of a string
(clamped at its two ends ) is given by
$y(x, t)=0.06 \sin \left(\frac{2 \pi}{3}\right) x \cos (120 \pi t)$
wherer $x, y$ are in $m$ and $t$ ini $s$. The length of the string is 1.5 m and its mass is $3 \times 10^{-2} \mathrm{~kg}$.

Answer the following: (i) Does the function represent a travelling or a stationary wave ?
(ii) Interpret the wave as a superimposition of two waves travelling in opposite directions.

What are the wavelength, frequency and speed of propagation of each wave?
(iii) Determing the tension in the string.

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19. A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45 Hz . The mass of the wire is $3.5 \times 10^{-2} \mathrm{~kg}$ and its linear mass density is
$4.0 \times 10^{-2} \mathrm{kgm}^{-1}$. What is (a) the speed of a transverse wave on the string, and (b) the tension in the string?

## D Watch Video Solution

20. A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53 k Hz . What is the speed of sound in steel?
21. A progressive wave of frequency 500 Hz is travelling with a velocity of $360 \mathrm{~m} / \mathrm{s}$. How far part are two points $60^{\circ}$ out of phase?

## D Watch Video Solution

22. An observer moves towards a stationary source of sound, with a velocity one-fifth of the velocity of sound. What is the percentage increase in the apparent frequency?

## Mcq

1. The periodic time of a body executing simple harmonic motion is 3 sec . After how much
time from time $t=0$, its displacement will be
half of its amplitude
A. $\frac{1}{8} s$
B. $\frac{1}{6} s$
C. $\frac{1}{4} s$

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

## Answer: C

## D Watch Video Solution

> 2. Two equations of two SHM
> $y=a \sin (\omega t-\alpha) \quad$ and $\quad y=a \cos (\omega t-\alpha)$.

The phase difference between the two is
A. $0^{0}$
B. $\alpha^{0}$
C. $90^{\circ}$

D. $180^{0}$

## Answer: C

## - Watch Video Solution

3. If a simple pendulum oscillates with an amplitude of 50 mm and time period of 2 sec , then its maximum velocity is
A. $0.10 m / s$
B. $0.15 \mathrm{~m} / \mathrm{s}$
C. $0.8 \mathrm{~m} / \mathrm{s}$
D. $0.26 \mathrm{~m} / \mathrm{s}$

Answer: B

## D Watch Video Solution

4. The equation of S.H.M. is
$y=a \sin (2 \pi n t+a)$, then its phase at time t is
A. $2 \pi n t$
B. $\alpha$
C. $2 \pi t+\alpha$
D. $2 \pi t$

Answer: C

D Watch Video Solution
5. The equation of simple harmonic motion
$y=a \sin (2 \pi t+\alpha)$ then its phase at time $\mathrm{t}=$

Os is
A. $2 \pi n t$
B. $\alpha$
C. $2 \pi t+\alpha$
D. $2 \pi t$

Answer: B

## D View Text Solution

6. A particle is oscillating according to the equation $X=7 \cos 0.5 \pi t$, where t is in
second. The point moves from the position of equilibrium to maximum displacement in time
A. $4 s$
B. $2 s$
C. $1 s$
D. 0.5 s

Answer: C

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7. The instantaneous displacement of a simple pendulum oscillator is given by
$x=A \cos \left(\omega t+\frac{\pi}{4}\right)$ Its speed will be maximum at time

> A. $\frac{\pi}{4 \omega}$
> B. $\frac{\pi}{2 \omega}$
> C. $\frac{\pi}{\omega}$
> D. $\frac{2 \pi}{\omega}$

Answer: A
8. The velocity of a particle in simple harmonic motion at displacement y from mean position is
A. $\omega \sqrt{\left(a^{2}+y^{2}\right)}$
B. $\omega \sqrt{\left(a^{2}-y^{2}\right)}$
C. $w y$
D. $\omega^{2} \sqrt{\left(a^{2}+y^{2}\right)}$

Answer: B
9. A particle is executing simple harmonic motion with a period of T seconds and amplitude a metre. The shortest time it takes
to reach a point $\frac{a}{\sqrt{2}}$ from its mean position in seconds is
A. $T$
B. $\frac{T}{8}$
C. $\frac{T}{4}$
D. $\frac{T}{16}$

## Answer: C

## D Watch Video Solution

10. Displacement between maximum potential
energy position energy potential and maximum kinetic energy position for a particle executing $S . H . M$ is
A. $-a$
B. $+a$
C. $\pm a$

## D. $\pm \frac{a}{4}$

## Answer: C

## D Watch Video Solution

11. If tension in the string is increased from 1

KN to 4 KN ,other factors remaining
unchanged, the frequency of the second harmonic will
A. be halved

## B. main changed

C. be doubled
D. becomes four times

## Answer: C

## D View Text Solution

12. An open organ pipe and a closed organ
pipe have the frequency of their first overtone identical. What is the ratio of their lengths?
A. $\frac{1}{2}$
B. $\frac{4}{3}$
C. $\frac{3}{4}$
D. 1

Answer: C

## D View Text Solution

13. The fundamental frequency of a stretched string is $V_{0}$. If the length is reduced by $35 \%$
and tension increased by $69 \%$ the

## fundamental frequency will be

A. $0.2 V_{0}$
B. $0.5 V_{0}$
C. $2.0 V_{0}$
D. $1.6 V_{0}$

Answer: C

D View Text Solution
14. Two waves of same frequency traveling in
the same medium in opposite direction when
super imposed give rise to
A. beats
B. harmonics
C. standing waves
D. resonance

Answer: C

D View Text Solution
15. Equation of progressive wav is given by
$y=0.2 \cos \pi\left\{(0.4 t+0.02 x)-\frac{\pi}{6}\right\}$
The
distance is expressed in cm and time in second. What will be the minimum distance between two particles having the phase difference of $\frac{\pi}{2}$ ?
A. 4 cm
B. 8 cm
C. 25 cm
D. 12.5 cm

## D View Text Solution

16. For two systems to be in resonance, which
of the following properties should be equal ?
A. Wavelength
B. Frequency
C. Amplitude
D. Wave velocity

Answer: B

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17. Fundamental frequency of a sonometer
wire is n . If the length, diameter and tensions
are doubled, the new fundamental frequency
will be
A. $n$
B. $\sqrt{2} n$
C. $\frac{n}{\sqrt{2}}$

$$
\text { D. } \frac{n}{2(\sqrt{2})}
$$

## Answer: D

## D View Text Solution

18. The frequency of an open organ pipe is $V$.

If half part of organ pipe is dipped in water then its frequency is
A. $V$
B. $\frac{V}{2}$
c. $\frac{V}{4}$
D. $O$

## Answer: A

## D View Text Solution

19. Two tuning forks when sounded together produce one beat per 0.4 s . Then the difference of their frequencies is
A. 0.2
B. 2
C. 5
D. 10

## Answer: C

## D Watch Video Solution

20. The angle between wave velocity and particle velocity in a travelling wave be
A. $90^{\circ}$
B. $60^{0}$
C. $0^{0}$
D. $120^{0}$

Answer: C

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