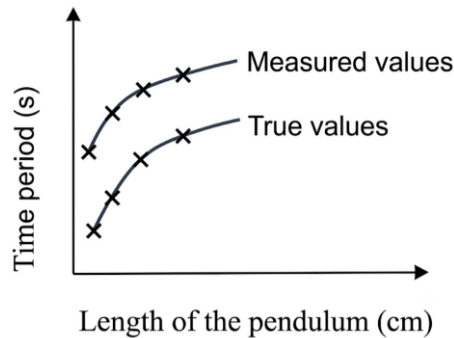


**PHYSICS
PAPER I**

For each question, there are **FOUR** responses: **A, B, C** and **D**. Choose the corresponding letter of your response and **CIRCLE** it. If you change your answer, cross out the previous response clearly and circle your new answer. **NO** score will be awarded if you circle more than **ONE** letter.

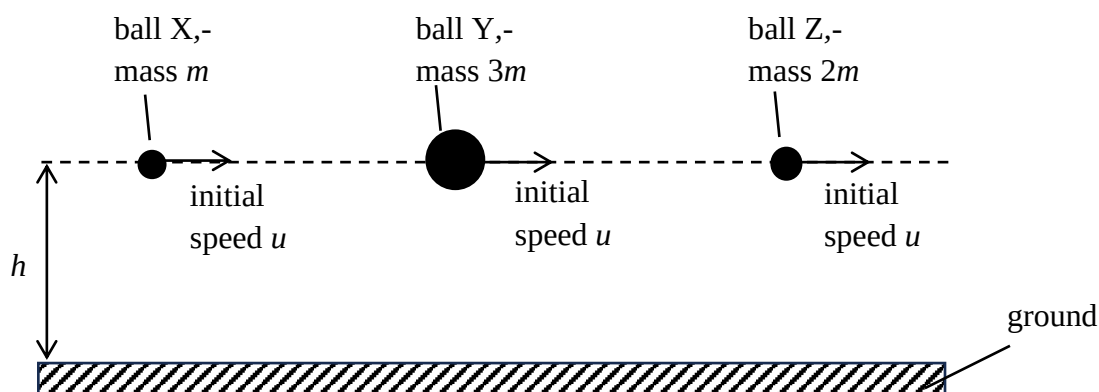
1. A student measures the time period of a simple pendulum for different lengths. The measured values are consistently greater than the true values as shown.



What is the most probable cause of this systematic difference?

- A The stopwatch has a positive zero error.
B The student starts and stops the stopwatch at random times.
C Air resistance causes the pendulum to lose energy during each oscillation.
D The student repeats too few measurements for each length.
2. An object moves in a straight line with positive velocity throughout its motion. A student makes the following statements about its velocity–time graph.
1. The slope of the graph gives the acceleration of the body.
 2. The area under the graph gives the displacement of the body.
 3. The y-intercept of the graph gives the final velocity of the body.
- Which of the statements are correct?
- A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3
3. A rescue helicopter is flying horizontally at a constant speed of 30 m s^{-1} above the ground. A survival kit is released directly above a stranded hiker. The hiker is walking at 2.0 m/s in the opposite direction to the helicopter. The kit reaches the ground 2.0 s after it is released. Where will the package land relative to the hiker? Air resistance is negligible.
- A 56 m behind the hiker
B 56 m ahead of the hiker
C 64 m behind the hiker
D 64 m ahead of the hiker

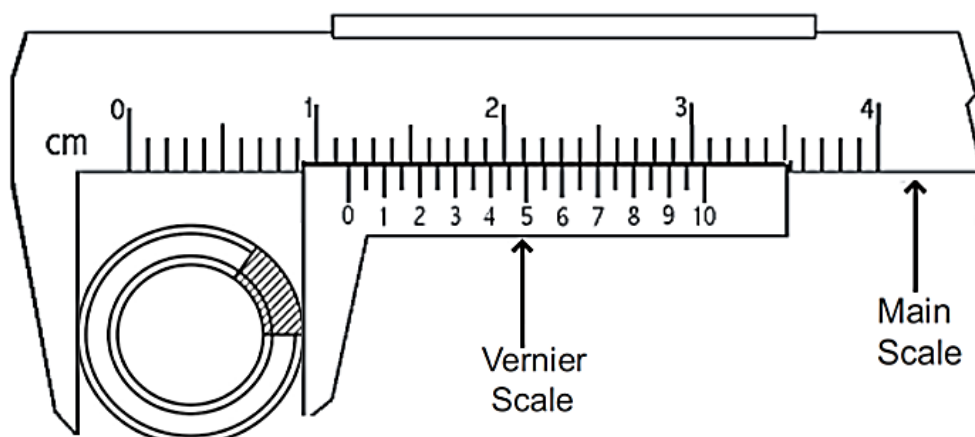
4. Three balls, X, Y and Z are projected horizontally at the same time from the same height h above the ground as shown.



Ball X has mass m and initial speed u , ball Y has mass $3m$ and initial speed $2u$ and ball Z has mass $2m$ and initial speed $3u$.

Which ball hits the ground first? Assuming Air resistance is negligible

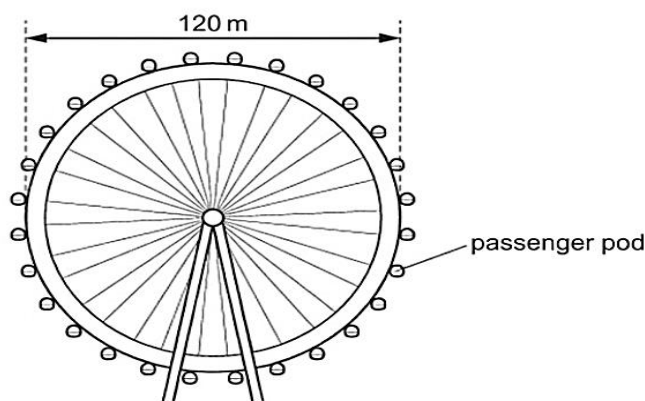
- A ball X
 - B ball Y
 - C ball Z
 - D all will hit the ground at the same time
5. A student uses a vernier calliper to measure the external diameter of a ring. The main scale reading and vernier scale coincidence are as shown.



The student records the measurement from the instrument. What is the correct value of the diameter of a ring?

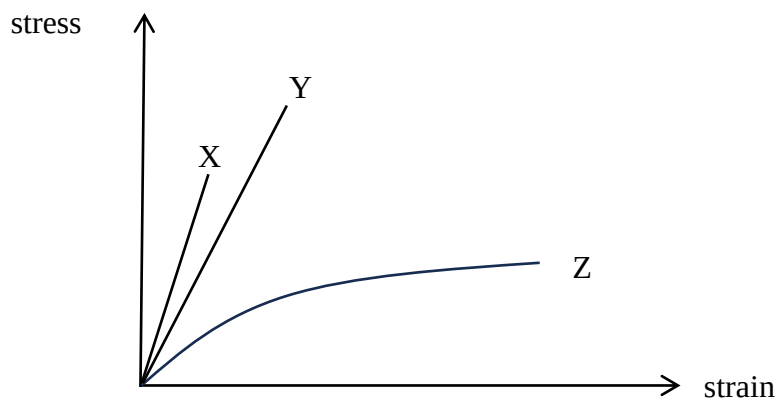
- A 0.965 cm
- B 1.065 cm
- C 1.150 cm
- D 1.165 cm

6. A big wheel has a diameter of 120 m and rotates at a steady speed, completing one rotation every 25 minutes.



What is the centripetal acceleration that a person in a passenger pod at the rim of the wheel experiences on the ride?

- A $1.1 \times 10^{-4} \text{ m s}^{-2}$
 - B $1.3 \times 10^{-3} \text{ m s}^{-2}$
 - C $2.1 \times 10^{-3} \text{ m s}^{-2}$
 - D $2.6 \times 10^{-3} \text{ m s}^{-2}$
7. The graph below shows the stress-strain curves for three different materials, X, Y and Z up to fracture.



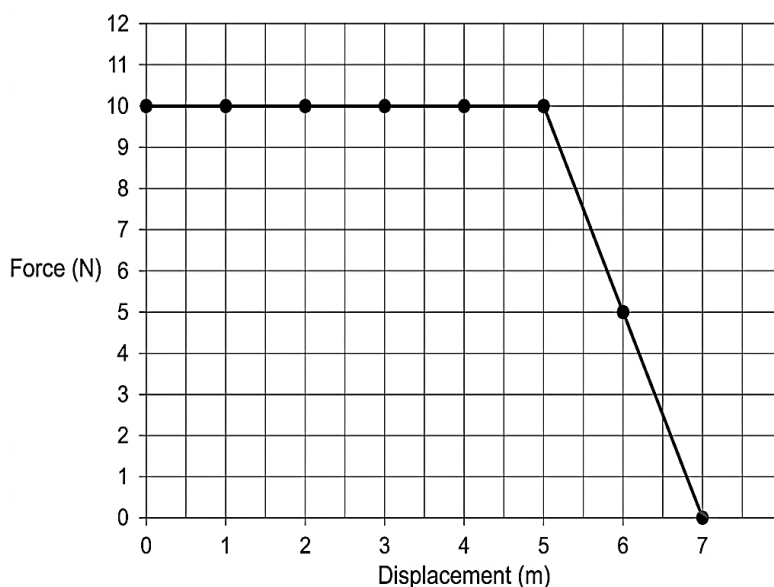
Here are three statements about the materials

1. Z has the greatest Young's modulus.
2. Y is stronger than X.
3. Y is stiffer than Z.

Which statements are correct?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

8. The graph shows the resultant force applied on an object of mass 2.0 kg as it starts from rest and moves a distance of 7.0 m.



What is the speed of the object after it has moved 7.0 m?

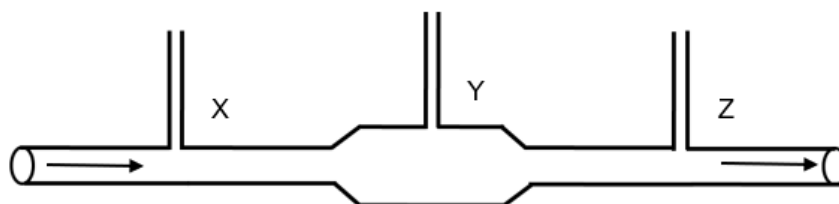
- A 7.7 m/s
 - B 60 m/s
 - C 30 m/s
 - D 8.4 m/s
9. A cannon-ball of mass 3.50 kg is fired at a speed of 22.0 m s^{-1} from a gun on a ship at a height of 6.00 m above sea level.

The total energy of the cannon-ball is the sum of the gravitational potential energy relative to the surface of the sea and the kinetic energy.

What is the total energy of the cannon-ball as it leaves the gun?

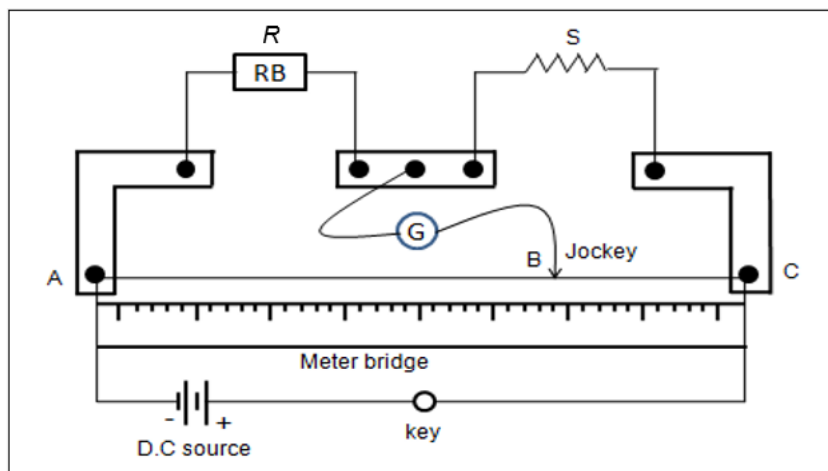
- A 206 J
- B 641 J
- C 847 J
- D 1050 J

10. The diagram shows a main water supply pipe close to a house. The house can be connected to the water supply at points X, Y or Z.



Which of the following statements explain why Y is the best place to connect to the supply?

- A Both velocity and pressure are minimum at Y
 - B Both velocity and pressure are maximum at Y.
 - C The velocity is maximum and pressure is minimum at Y.
 - D The velocity is minimum and the pressure is maximum at Y.
11. The circuit shown is set up to determine the resistance of an unknown resistor of resistance S. The resistance of the resistance box (R.B) is constant and equal to R. The length of the resistance wire is L and the null point is found when the jockey is at a points B.



Which ratio can be used to find S?

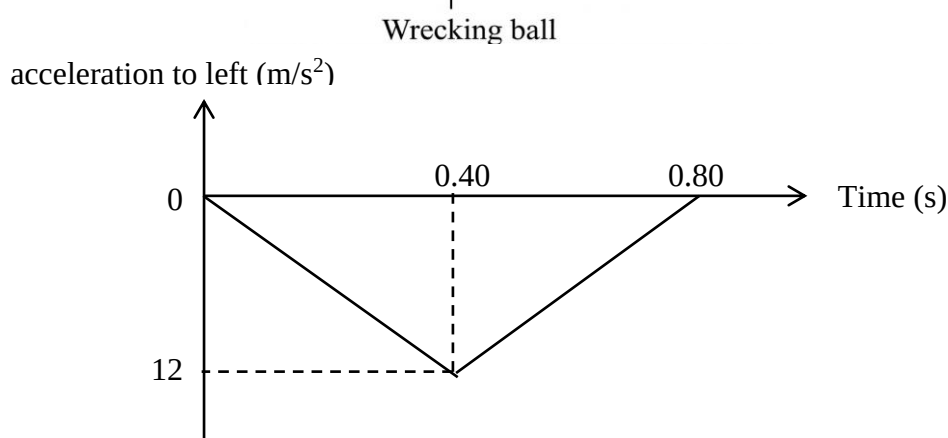
- A $\frac{R}{S} = \frac{AB}{L}$
- B $\frac{R}{S} = \frac{AB}{L}$
- C $\frac{R}{S} = \frac{L-AB}{AB}$
- D $\frac{S}{R} = \frac{L-AB}{AB}$

12. Lhaki's physics teacher instructed her to obtain a same-size inverted image of an object pin using a concave mirror with a focal length of 30 cm.

How far should the object pin be placed from the mirror?

- A 15 cm
- B 30 cm
- C 45 cm
- D 60 cm

13. A wrecking ball of mass 500 kg is used to demolish an old house. The ball is travelling horizontally at speed v when it hits the house and is brought to rest by the collision. The graph shows how the horizontal acceleration of the wrecking ball toward the building (to the left) varies with time during the collision.



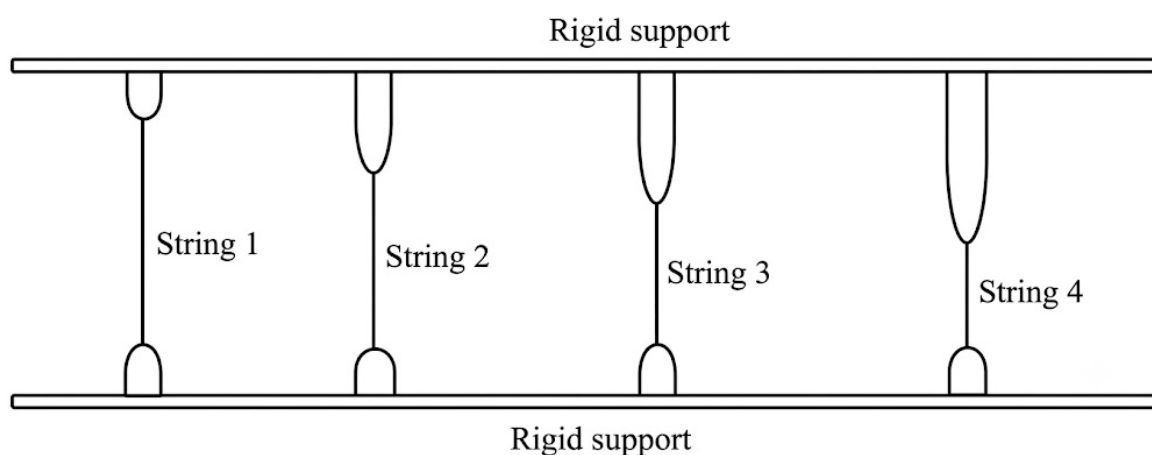
What is the initial speed v of the wrecking ball and the maximum force F it exerts on the house?

	initial speed (m/s)	maximum force (N)
A	2.4	400
B	2.4	6000
C	4.8	400
D	4.8	6000

14. A body is in simple harmonic motion along the x-axis, oscillating between $x = -4.0$ cm and $x = +4.0$ cm.

At what point along the axis does the body have the maximum potential and at what point does it have maximum acceleration?

	position of maximum potential energy	position of maximum acceleration
A	$x = 0$ cm	$x = 0$ cm
B	$x = 0$ cm	$x = \pm 4.0$ cm
C	$x = \pm 4.0$ cm	$x = 0$ cm
D	$x = \pm 4.0$ cm	$x = \pm 4.0$ cm



15. A sonometer is set up so that when the string is plucked it emits a sound of frequency 250 Hz.

The following changes can be made to the sonometer whilst keeping all other parameters constant:

1. increase the length of the string
2. increase the tension in the string
3. increase the mass per unit length of the string
4. increase the force with which the string is plucked

Which change results in the sonometer emitting sound of higher frequency?

- A 1 only
 B 2 only
 C 3 only
 D 4 only

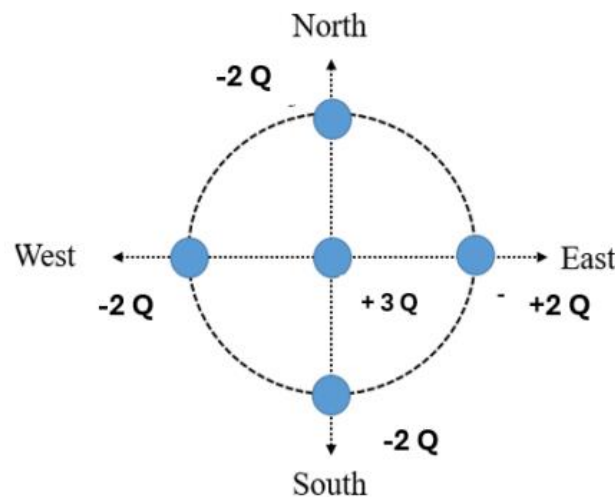
16. A cosmetic skin cream has low surface tension.

How does this affect its properties?

- A increases its viscosity
 - B increases its spread ability
 - C increases its solubility
 - D increases its fragrance
17. A student spilled mercury on the table while performing a science experiment and observed that the smaller drops of mercury are more spherical than the larger drops.

What explains this observation?

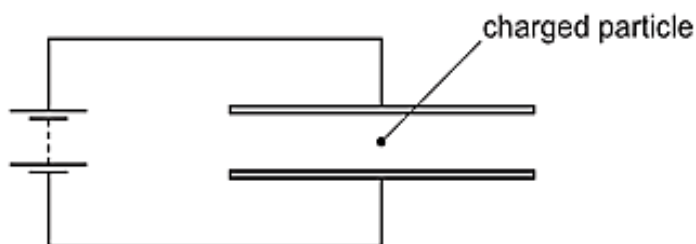
- A Gravitational forces dominate the force of surface tension in small drops.
 - B The force of surface tension dominates viscous forces in small drops.
 - C The force of surface tension dominates gravitational forces in small drops.
 - D Viscous forces dominate the force of surface tension in small drops.
18. The diagram shows a charge ($+3Q$) at the centre of a circle which is surrounded by four other charges which are at an equal distance from the centre.



What is the direction of the resultant electrostatic force on the charge at the centre?

- A East
- B West
- C North
- D South

19. A charged particle is in the electric field between two horizontal metal plates connected to a battery, as shown. There is a force F on the particle due to the electric field.



The separation of the plates is doubled.

What is the new force on the particle?

- A $\frac{F}{4}$
 B $\frac{F}{2}$
 C F
 D $2F$
20. Two protons are separated by a distance d . The electrostatic force exerted on each proton is F .

Two alpha particles are separated by the same distance d .

What is the force exerted on each alpha particle?

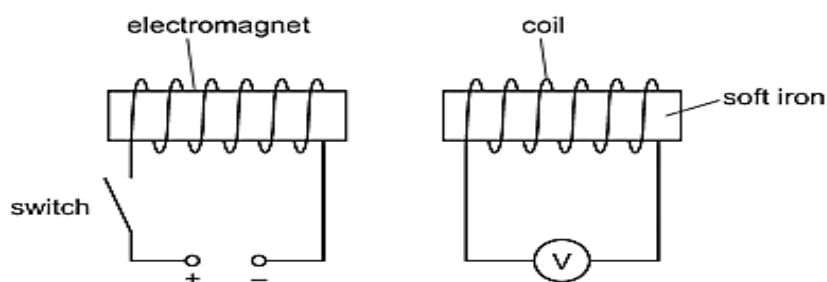
- A F
 B $2F$
 C $4F$
 D $16F$
21. A simple coil of N turns and area A is placed so that its plane is perpendicular to a uniform magnetic field. The flux through the coil is Φ .

A second coil with $2N$ turns and area $2A$ is placed in the same orientation in the same uniform magnetic field.

What is the flux and flux linkage through the second coil?

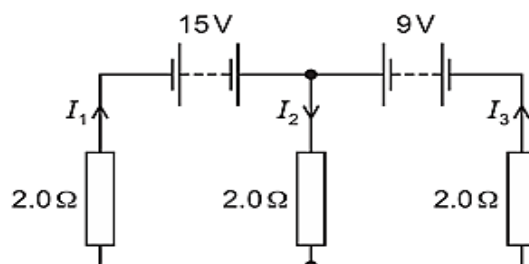
	Flux	Flux-linkage
A	2Φ	$2N\Phi$
B	2Φ	$4N\Phi$
C	4Φ	$2N\Phi$
D	4Φ	$4N\Phi$

22. Which experiment results in an induced emf in a wire loop?
- A The loop of wire is held stationary with its plane perpendicular to a uniform magnetic field.
 - B The loop of wire is held stationary with its plane parallel to a uniform magnetic field.
 - C The loop of wire is held stationary with its plane perpendicular to a changing magnetic field.
 - D The loop of wire is held stationary with its plane parallel to a changing magnetic field.
23. The diagram shows an electromagnet near a coil of wire connected to a voltmeter. The reading on the voltmeter is zero.



The switch is closed. The electromagnet magnetises quickly.
What happens to the reading on the voltmeter?

- A It keeps increasing.
 - B It quickly increases and stays at maximum.
 - C It quickly increases and then decreases.
 - D It stays on zero.
24. In the circuit shown, the batteries have negligible internal resistance.



What are the values of the currents I_1 , I_2 and I_3 ?

	I_1/A	I_2/A	I_3/A
A	-5.5	1.0	6.5
B	0.5	4.0	3.5
C	3.5	4.0	0.5
D	6.5	1.0	-5.5

25. Here are three statements about copper and germanium.
1. The resistivity of copper increases with temperature whereas the resistivity of germanium decreases with increasing temperature.
 2. The forbidden gap in copper is greater than the forbidden gap in germanium.
 3. At room temperature copper has more charge carriers per unit volume than germanium.

Which statements are correct?

- A 1 only
B 2 only
C 2 and 3 only
D 1 and 3 only
26. What is the phase relationship between the supply voltage and current in an R–C series circuit?
- A The current lags the voltage by 90° .
B The current leads the voltage by 90° .
C The current leads the voltage by 180° .
D The voltage and current are in phase.
27. In a laboratory experiment to determine the focal length of a convex lens using the u–v method, the following data were recorded.

u(cm)	v (cm)
36	44
40	42
44	38

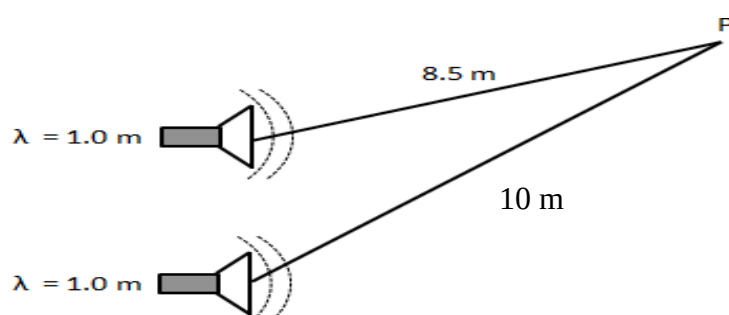
What is the average value of the focal length of the given lens?

- A 19.8 cm.
B 20.2 cm.
C 20.4 cm.
D 20.5 cm.
28. Which of the following properties of light can be explained using Huyghens principle?
1. Refection
 2. Refraction
 3. Diffraction
 4. Interference
- A 1 only
B 1 and 2 only
C 1, 2 and 3 only
D 1, 2, 3 and 4

29. A swimmer in the middle of the ocean observes two waves of amplitude A and with the same wavelength approaching him from opposite directions.

The waves reach him in phase, what is the resultant amplitude at his location?

- A 0
B A
C $2A$
D $4A$
30. Two loudspeakers each emit sound of wavelength 1.0 m . The sounds are in phase as they leave the speakers and superpose at point P. The path lengths from each speaker to point P are shown in the diagram.



What is the phase difference between the waves at point P and what type of interference occurs at point P?

	phase difference	interference type
A	90°	constructive
B	90°	destructive
C	180°	constructive
D	180°	destructive

31. Monochromatic light is incident on a single slit and forms a diffraction pattern on a screen.

The width of the slit is reduced.

What happens to the width and brightness of the central maximum?

	width	brightness
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

32. Despite the widespread use of nuclear fission reactors to generate energy, many developed countries are hoping to use thermonuclear fusion reactors in the future.

Here are four statements comparing fusion reactors with fission reactors:

1. Both fusion reactors and fission reactors produce large amounts of long-lived radioactive waste.
2. Fusion reactions produce more energy per kilogram of fuel than fission reactions.
3. Fusion reactors are safer because there is no risk of a meltdown if something goes wrong.
4. There is an almost unlimited supply of fuel for fission reactors but a limited supply for fusion reactors.

Which statements are correct?

- A 1 and 2
B 2 and 3
C 3 and 4
D 1 and 4

33. Some properties of light are best explained using a wave model and others are best explained using a particle model.

Which row in the table is correct about these models?

	wave model	particle model
A	interference patterns	photoelectric effect
B	interference patterns	diffraction patterns
C	photoelectric effect	interference patterns
D	diffraction patterns	photoelectric effect

34. Four groups of students carry out an experiment on the emission of electrons from the same metal using lasers.

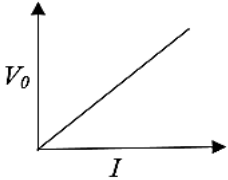
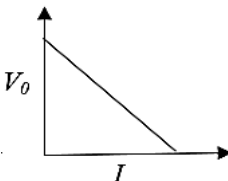
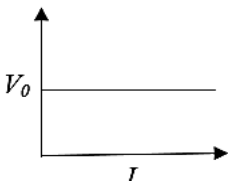
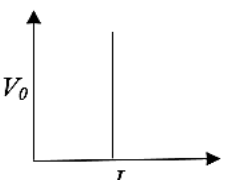
Two groups use red lasers which emit light of the same wavelength, with one laser being brighter than the other. The other two groups use green lasers which emit light of the same wavelength, with one laser being brighter than the other.

Which group or groups produces the highest-energy photoelectrons?

- A both groups using the green lasers
B both groups using the red lasers
C only the group using the brighter green laser
D only the group using the brighter red laser

35. A photoelectric experiment is carried out to investigate the relationship between the stopping potential and the intensity of incident light. The wavelength of the light is kept constant.

Which graph shows the expected relationship between stopping potential (V_0) and intensity (I) of incident light?

A	
B	
C	
D	

36. Which row in the table correctly identifies the type of particle and quark structure of a neutron?

	particle type	quark structure
A	baryon	up, up, down
B	baryon	up, down, down
C	meson	up, up, down
D	meson	up, down, down

37. Nuclear fission is one of the solutions to energy crises in the world.

Which sequence of energy transfers takes place inside a nuclear fission reactor?

- A nuclear to chemical to kinetic to electrical
- B nuclear to chemical to thermal to electrical
- C nuclear to thermal to chemical to electrical
- D nuclear to thermal to kinetic to electrical

38. Samples of copper and silicon are cooled from 300 K to 100 K.

What happens to the resistance of each sample?

	resistance of copper	resistance of silicon
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

39. Arrange the following developmental phases of satellite development in sequential order.

- I. Launch and operation
- II. Breadboard model
- III. Flight model
- IV. Mission definition
- V. Engineering model

- A II, IV, V, I, III
- B IV, II, III, V, I
- C IV, II, V, III, I
- D V, II, I, III, IV

40. Satellites in high orbit are disposed of by sending them to a graveyard orbit lying beyond the geostationary orbit when they are no longer in use.

Why is this done?

- A to improve satellite communication
- B to increase the satellite's lifespan
- C to minimise the risk of collision with operational satellites
- D to reduce the satellite's exposure to harmful radiation

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