INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
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PHYSICS
STANDARD LEVEL
PAPER 1

Monday 19 November 2001 (afternoon)

45 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. Repeated measurements of a quantity can reduce the effects of

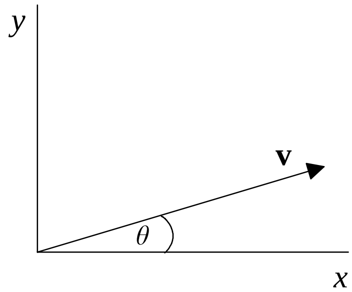
A. both random and systematic errors.

B. only random errors.

C. only systematic errors.

D. neither random nor systematic errors.

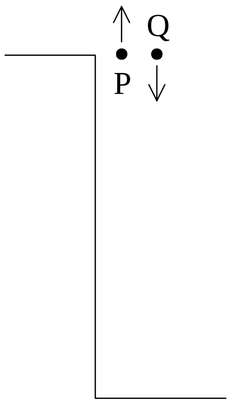
2. A vector **v** makes an angle θ with the x axis as shown.



As the angle θ increases from 0° to 90°, how do the x and y components of **v** vary?

	***x* component**	***y* component**
A.	Increases	Increases
B.	Increases	Decreases
C.	Decreases	Increases
D.	Decreases	Decreases

3. Two stones P and Q are thrown from the top of a cliff, one straight up and the other straight down, at the same initial speed. Both eventually hit the ground.



If air resistance is negligible, what will be true of the **speeds** with which the stones hit the ground?

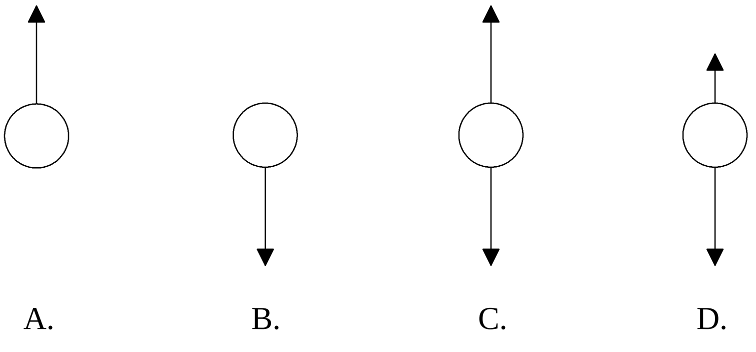
A. Stone P hits the ground with the greater speed.

B. Stone Q hits the ground with the greater speed.

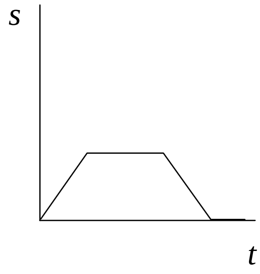
C. Both stones hit the ground with the same speed.

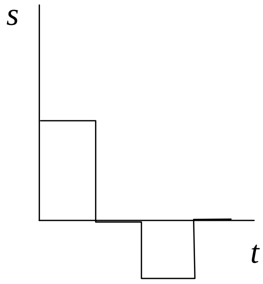
D. The comparative speeds of impact depend on the height of the cliff.

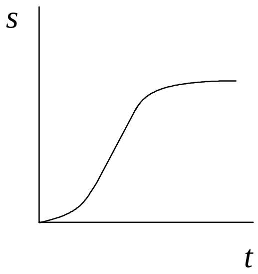
4. A ball is thrown vertically upward. If air resistance is negligible, which **one** of the diagrams below is the correct free-body force diagram showing the **force(s)** on the ball when it is on the way up?

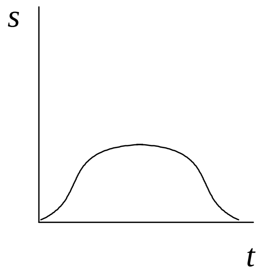


5. A car travels along a straight road. It first accelerates from rest, then travels at a constant velocity, then decelerates to a stop. It then remains at rest. Which graph below best represents the **displacement** *s* of the car as a function of time *t*?

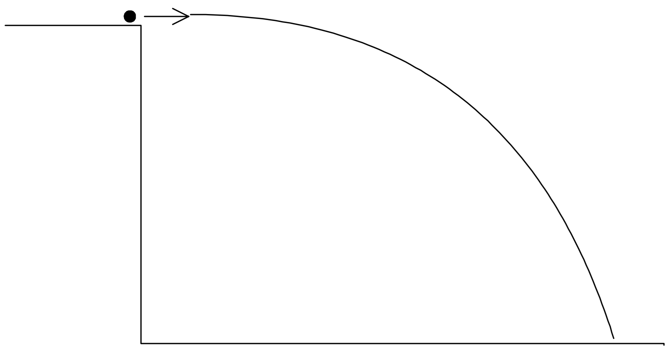
A.


B.


C.


D.


6. An iron cannon ball is projected horizontally from a cliff and lands on the ground below, a certain distance from the base of the cliff. Air resistance is negligible.



If a **more massive** iron ball were to be projected at the **same** speed,

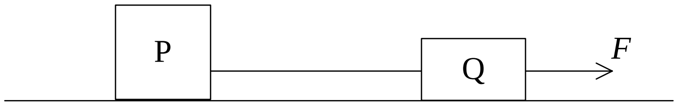
A. it would land at the same place.

B. it would land closer to the cliff.

C. it would land further away.

D. it would land either further away or closer to the cliff depending on the height of the cliff and the speed of projection.

7. Two bodies P and Q on a frictionless horizontal surface are connected by a light cord. The mass of P is greater than that of Q. A force *F* is applied to Q as shown, accelerating the bodies to the right.



The magnitude of the force exerted by the connecting cord on **body P** will be

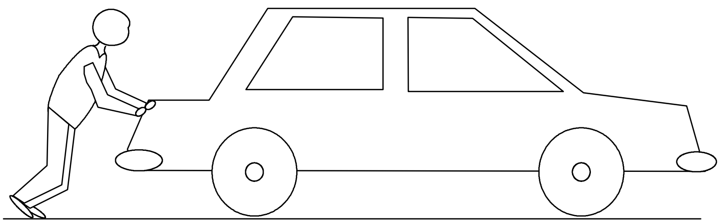
A. zero.

B. less than *F* but not zero.

C. equal to *F*.

D. greater than *F*.

8. A man pushes a car along a road. He exerts a force *F* on the car.



In this situation, what is the equal and opposite force to *F* (*i.e.* 'reaction' force) as referred to in Newton's third law?

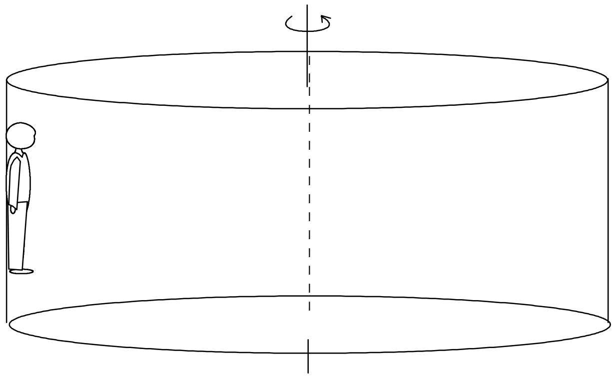
A. The force exerted **on** the person **by** the car.

B. The force of friction **on** the car **by** the road.

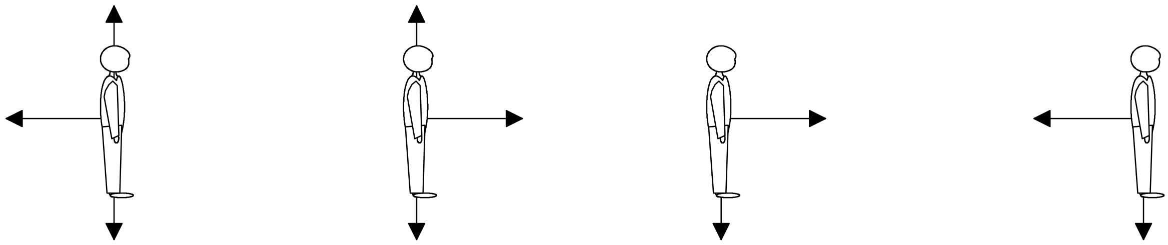
C. The force of gravity **on** the car **by** the earth.

D. There is no reaction force if the car moves in the direction of *F*.

9. An amusement park ride sometimes called ‘the fly’ is a large cylinder which can rotate. A person stands against the wall, and after the cylinder is rotating at a certain rate the floor drops away. The person remains ‘stuck’ in position against the wall - like a fly.

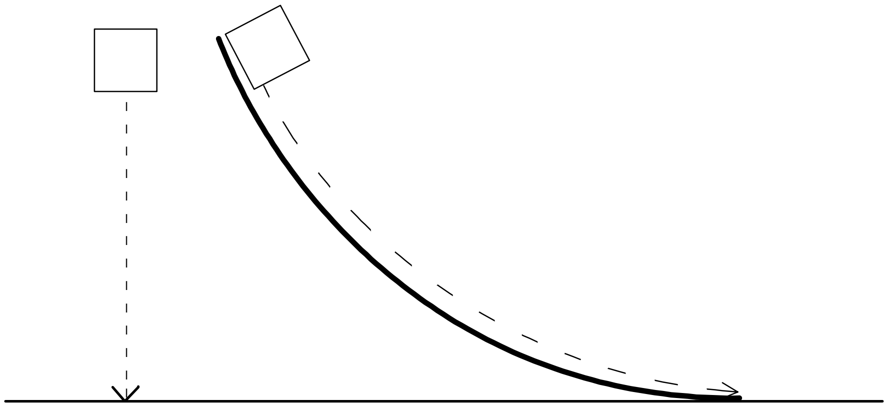


Which **one** of the following is the correct free-body force diagram showing all the forces acting on the person when the person is in the position shown above?



A. B. C. D.

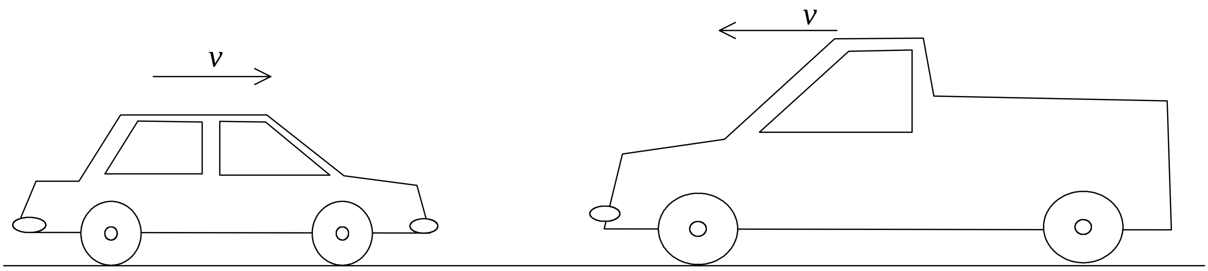
10. One block is dropped to the ground, while an identical block slides down a slope to the ground, as shown in the figure. The blocks start from rest at the same height and friction is negligible.



Which **one** of the following is true of the comparative **speeds** of the blocks when they reach the ground, and the **times** they take to get there?

	Speed	Times
A.	Same	Same
B.	Same	Different
C.	Different	Same
D.	Different	Different

11. A car and a truck travelling with equal speeds in opposite directions collide head-on. The truck is more massive than the car.



How will the momentum **changes** of the vehicles compare in the collision?

A. The car will have the greater momentum change.

B. The truck will have the greater momentum change.

C The car and truck will have equal but opposite momentum changes.

D. One cannot compare momentum changes for an inelastic collision such as this.

12. The volume and temperature of a sample of an ideal gas can be adjusted. Which combination of these changes will **always** result in a greater gas pressure?

	Volume	**Temperature**
A.	Increase	Increase
B.	Increase	Decrease
C.	Decrease	Increase
D.	Decrease	Decrease

13. When the volume of an enclosed gas is **increased** at constant temperature, the pressure exerted by the gas on the container wall **decreases**. Consider the following statements as possible explanations for this:

I. the average speed at which gas molecules strike the walls decreases.

II. the rate at which molecules strike a given area of the walls decreases.

The pressure decrease is explained by

A. I only.

B. II only.

C. I and II.

D. neither I nor II.

14. Equal masses of water and alcohol, initially at different temperatures, are mixed. The specific heat capacity of water is **greater** than that of alcohol. The final temperature of the mixture will be

A. equal to the sum of the two original temperatures.

B. exactly midway between the two original temperatures.

C. closer to the original temperature of the water than of the alcohol.

D. closer to the original temperature of the alcohol than of the water.

15. A lead bullet is fired into an iron plate, where it deforms and stops. As a result, the temperature of the lead increases by an amount ΔT. For an identical bullet hitting the plate with **twice** the speed, what is the best estimate of the temperature increase?

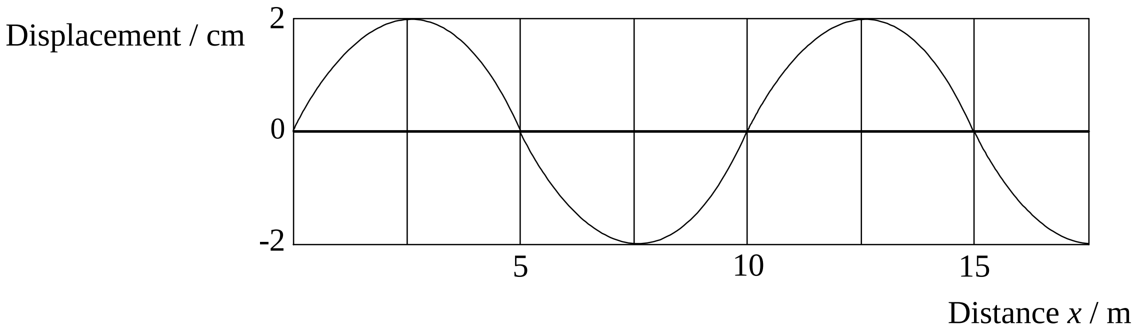
A. ΔT

B. $\sqrt{2}\,\Delta T$

C. $2\,\Delta T$

D. $4\,\Delta T$

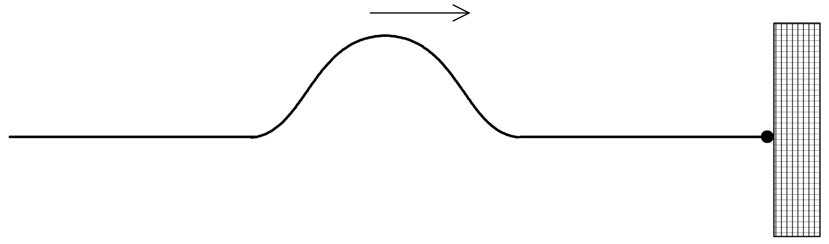
16. The diagram below represents a sinusoidal wave travelling in the *x* direction, at a particular instant in time.



The amplitude and wavelength of this wave are respectively

	Amplitude	Wavelength
A.	2 cm	5 m
B.	2 cm	10 m
C.	4 cm	5 m
D.	4 cm	10 m

17. A wave pulse travels on a rope toward a fixed end as shown.



When it encounters the fixed end, the pulse will

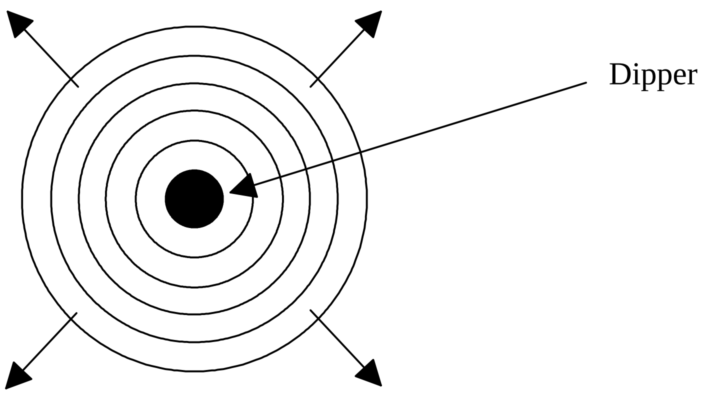
A. be absorbed.

B. become a stationary pulse.

C. be reflected back, but inverted.

D. be reflected back, not inverted.

18. Circular water waves are produced by a dipper oscillating up and down into the water. The circles in the diagram represent wave crests moving outward on the water surface.



If the frequency of the dipper is doubled, the distance between the crests of the waves will

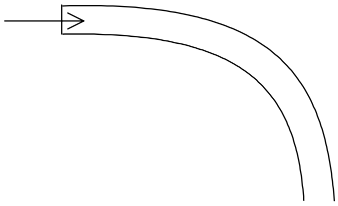
A. remain unchanged.

B. halve.

C. double.

D. quadruple.

19. Light enters one end of a curved glass rod.



The curvature of the rod is great enough that total internal reflection of the light does **not** occur. Which of the following best describes what will happen to the light?

A. It will be absorbed in the rod.

B. It will be reflected back out of the same end.

C. It will continue along in its original path and pass out of the rod without any deflection.

D. It will be refracted out of the side of the rod.

20. Wave **polarisation** can occur

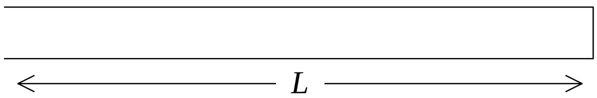
A. only for traverse waves.

B. only for longitudinal waves.

C. for both traverse and longitudinal waves.

D. for neither transverse nor longitudinal waves.

21. An organ pipe of length L is open at one end and closed at the other. The fundamental (lowest frequency) standing sound wave is set up in the pipe.



What is the wavelength of the fundamental, in terms of the length L of the pipe? Ignore any end correction.

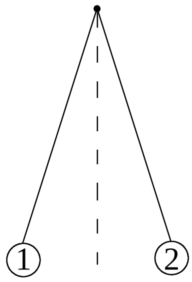
A. $\frac{L}{4}$

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

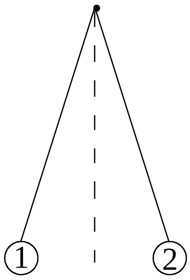
C. $2L$

D. $4L$

22. Two equally charged balls of the same mass are suspended from strings and hang apart at an angle as shown.

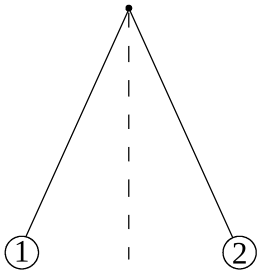


If the charge on **Ball 1 alone** were increased, how would the two balls hang?

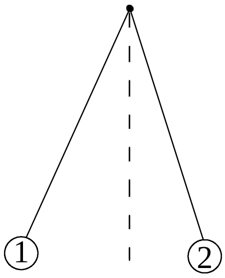


unchanged

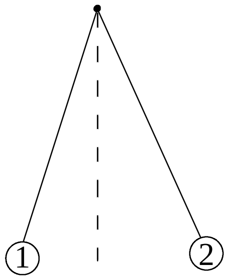
A.



B.



C.



D.

23. A charged oil drop is between two parallel plates. The potential difference between the plates is adjusted so that the drop is at rest. If the oil drop coalesces (combines) with another **uncharged** oil drop, then the combined drop will

A. move upwards.

B. move downwards.

C. remain at rest.

D. move either upwards or downwards depending on the mass of the second drop.

24. A potential difference is applied across a pair of parallel plates in a vacuum. A proton between the plates experiences an acceleration of magnitude a. What would be the acceleration of an alpha particle?

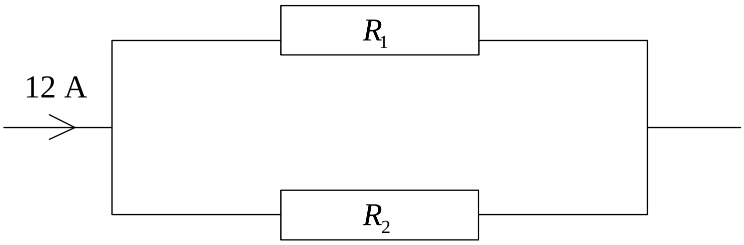
A. $\frac{a}{4}$

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

C. a

D. $2a$

25. Two resistors R_1 and R_2 in parallel form part of a circuit. R_1 has **three** times the resistance of R_2, and the total current flowing into the parallel pair is 12 A as shown.



The current through R_1 is

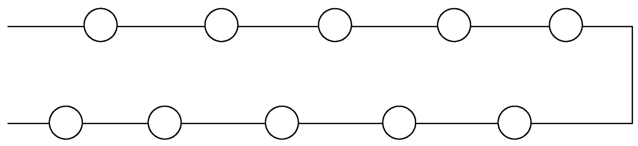
A. 3 A.

B. 4 A.

C. 8 A.

D. 9 A.

26. A simple form of lighting for decorating trees sometimes consists of a string of small light bulbs connected in series as shown.



With this simple system, if one of the bulbs burns out (its filament breaks) then the others will

A. all go out.

B. glow dimmer than before.

C. glow just as bright as before.

D. glow brighter than before.

27. Cathode rays consist of

A. electrons.

B. photons.

C. helium nuclei.

D. neutrons.

28. J J Thomson measured the charge-to-mass ratio $\frac{e}{m}$ of the electron by arranging that

A. electrons passed undeflected through crossed electric and magnetic fields.

B. electrons moved in a parabolic path in an electric field.

C. electrons moved in a circular arc in a magnetic field.

D. the weight of a charged oil drop was balanced by an upward electric force.

29. Thermionic emission is

A. the emission of radiation from a hot object.

B. the emission of particles from a radioactive substance.

C. the ejection of electrons from a surface by incident radiation.

D. the emission of electrons from a hot object.

30. Nuclide X decays with a half-life of 20 days to stable nuclide Y. At a particular time, a sample consists of nuclides X and Y in the ratio 1 : 1. How much time will elapse before the ratio becomes 1 : 3?

A. 20 days

B. 40 days

C. 60 days

D. 80 days