

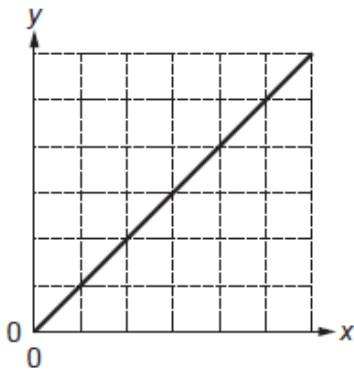
AS Level Physics B

H157/01 Foundations of physics

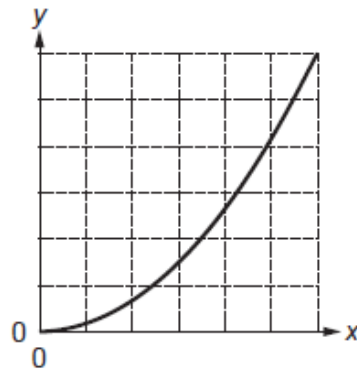
Question Set 2 (Module 4 MCQs)

Questions 1 and 2 are about these graphs.

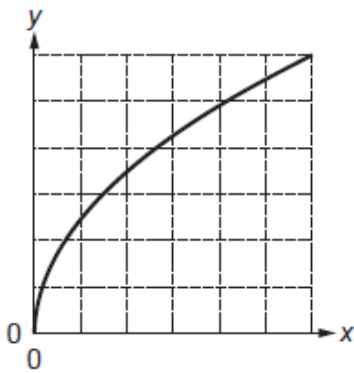
1. The graphs A–D represent different relationships between variables.



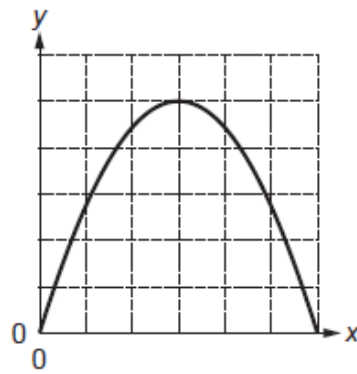
A



B



C



D

Which graph, A, B, C or D, best represents the relationship between the variables x and y where:

y is the velocity of an object falling freely from rest

x is the time taken?

Your answer

[1]

2. Which graph, A, B, C or D, best represents the relationship between the variables x and y where:

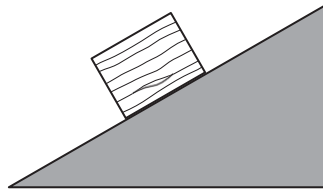
y is the velocity of an object falling freely from rest

x is the distance fallen?

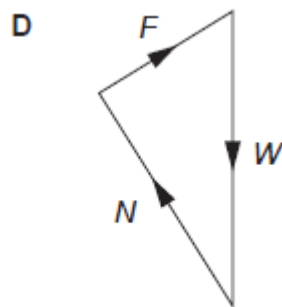
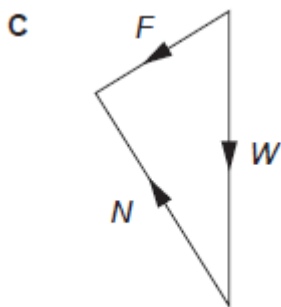
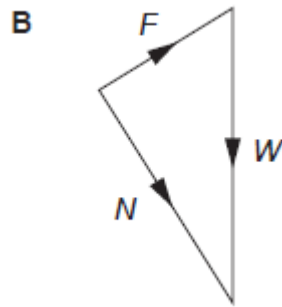
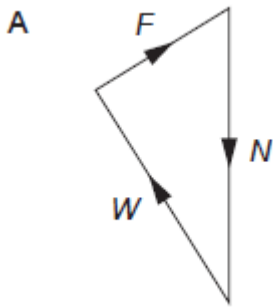
Your answer

[1]

3. The diagram shows a block with weight W at rest on an inclined surface.



The frictional force, F , prevents the block from sliding. N is the normal contact force. Which diagram shows the vector sum of the forces on the block?



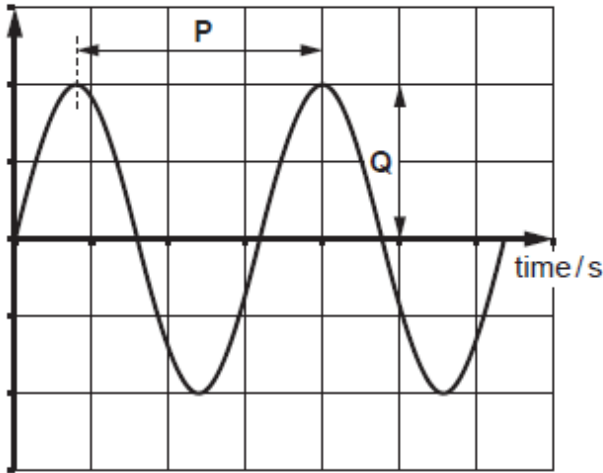
Your answer

[1]

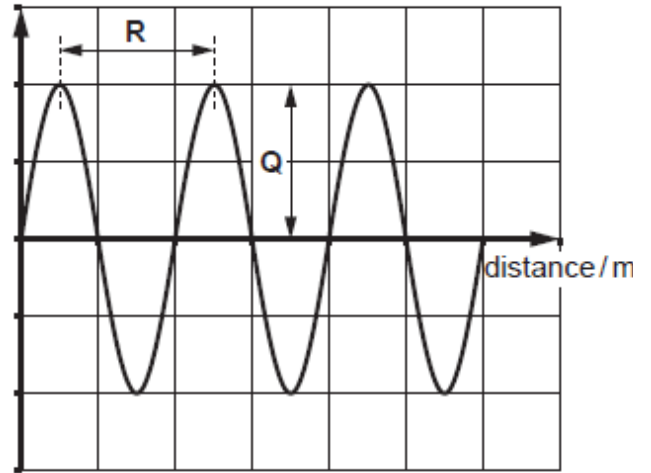
4. The graphs below describe a sound wave.

P, Q and R are intervals of time or distance as indicated on the graphs.

displacement / m



displacement / m



Which calculation gives the speed of this wave?

- A $P \times R$
- B $\frac{P}{R}$
- C $\frac{R}{P}$
- D $R \times Q$

Your answer

[1]

5. A ball, initially at rest, is struck by a hockey stick. It leaves the hockey stick at speed v .

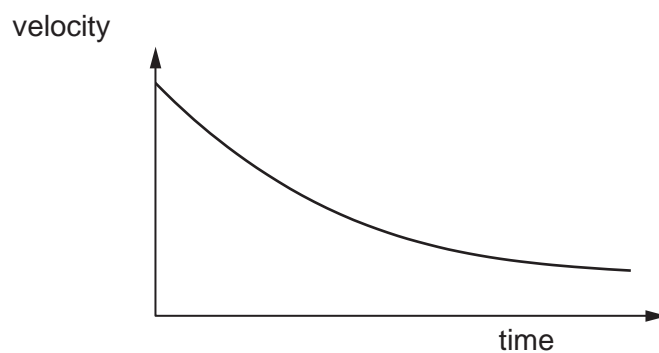
Which quantity, together with the mass of the ball, can be used to determine v ?

- A The time of the impact.
- B The weight of the hockey stick.
- C The impulse of the force on the ball.
- D The final momentum of the hockey stick.

Your answer

[1]

6. The velocity-time graph represents the motion of a parachutist after her parachute opens, but before she reaches terminal velocity.



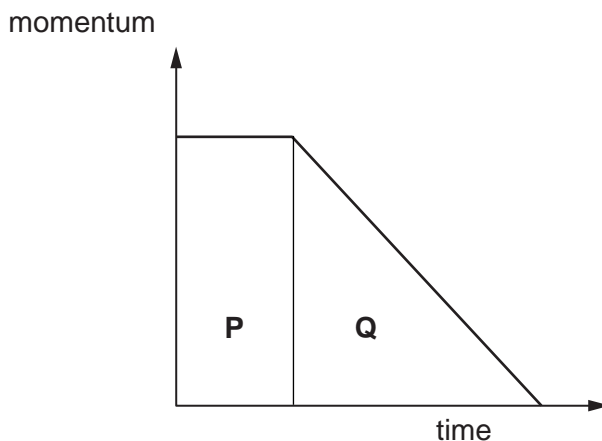
During the time shown in the graph, which row is correct?

	air resistance	resultant force	direction of resultant force
A	decreases	decreases	down
B	decreases	decreases	up
C	increases	decreases	down
D	increases	increases	up

Your answer

[1]

7. The graph represents the motion of a car stopping in an emergency. The driver takes a short time to react before applying the brakes.



Which statement is correct?

- A Area **P** does not depend on the initial velocity.
- B The braking force is the gradient of the graph in section **Q**
- C If the braking force is increased, the area **Q** will increase.
- D The total distance travelled before stopping is the sum of areas **P** and **Q**.

Your answer

[1]

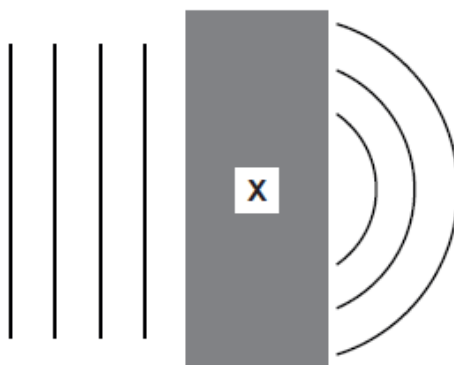
8. Which is an expression for energy?

- A Fv where F is the force causing a body to move and v is its speed.
- B I^2R where I is the current in a resistance of value R .
- C mv where m is the mass of a body moving with velocity v .
- D VIt where V is the potential difference across a conductor, I is the current through it and t is the time for which the current flows.

Your answer

[1]

9. The diagram shows plane wavefronts incident on a region **X**. The contents of region **X** are hidden from view.



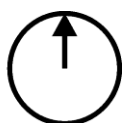
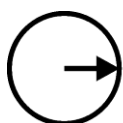
Region **X** is most likely to contain ...

- A a converging lens.
- B a narrow slit.
- C a polarising filter.
- D a rectangular plastic block.

Your answer

[1]

10. Two photons from the same monochromatic laser arrive at a detector via two possible paths. The phasor representing each photon path is shown below. The amplitude of each phasor is 1 unit.



The resultant phasor amplitude for these two possible paths at the detector is:

- A 0
- B 1.0 unit
- C 1.4 units
- D 2.0 units

Your answer

[1]

11. The $\frac{\text{height of a person}}{\text{wavelength of visible light}}$ ratio is of the order of:

A 10^2

B 10^4

C 10^6

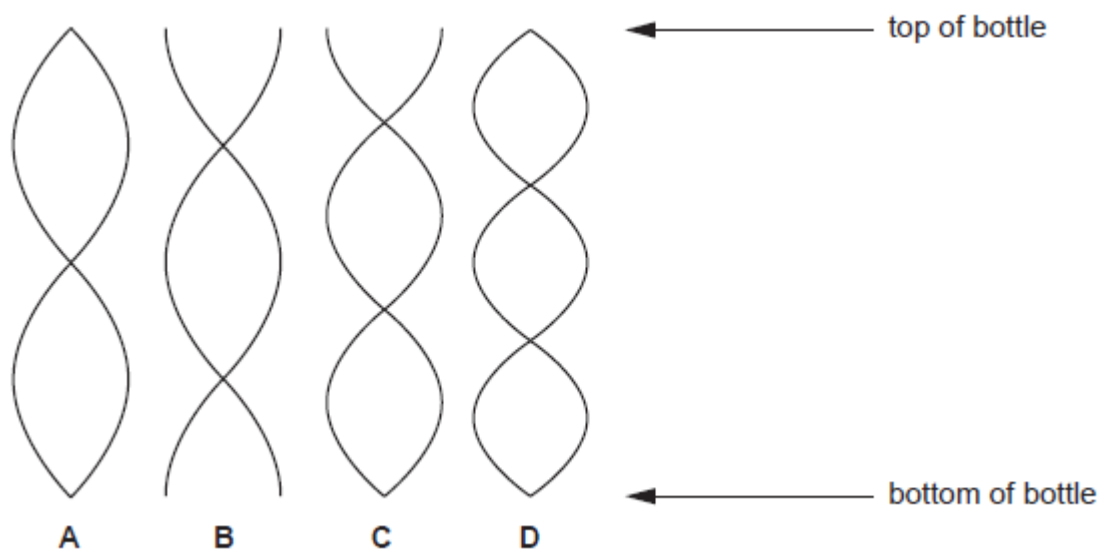
D 10^8

Your answer

[1]

12. A student blows across the open top of an empty bottle.

Which diagram represents a standing wave that can be produced in the air in the bottle?

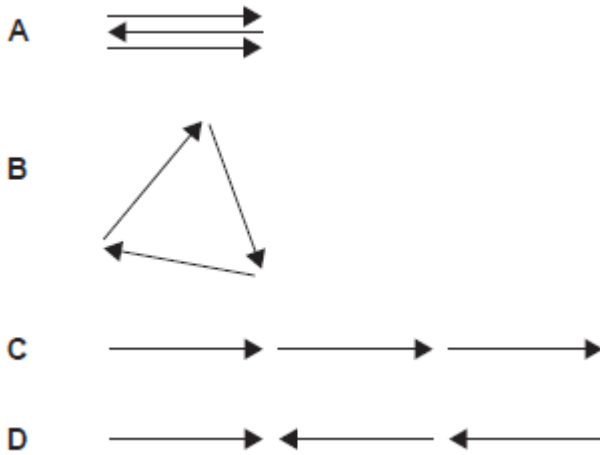


Your answer

[1]

13. Monochromatic light passes through 3 closely spaced parallel slits at a point. A maximum is produced at a point on a distant screen where the phase difference between light from successive slits is π radians.

Which phasor diagram represents the constructive interference at this point?



Your answer

[1]

14. Light can be modelled as a wave or as particles (photons).

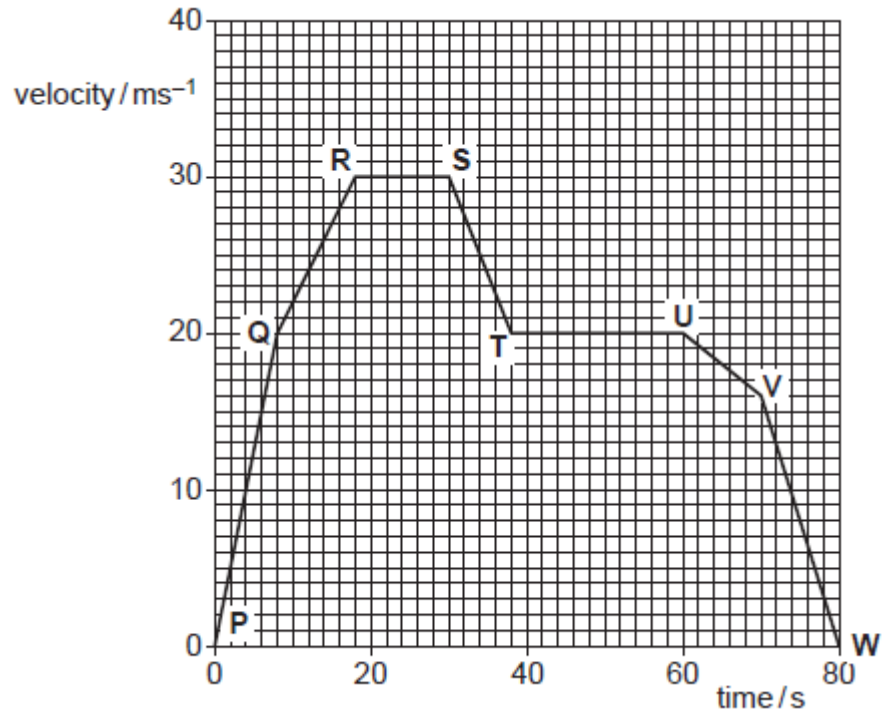
Which one of these phenomena can **only** be explained if light is made of photons?

- A diffraction
- B photoelectric effect
- C polarisation
- D reflection

Your answer

[1]

15. Here is a velocity-time graph for a car.



Between which points does the car have the largest acceleration?

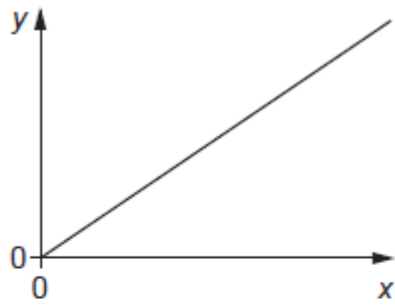
- A P and Q
- B Q and R
- C S and T
- D V and W

Your answer

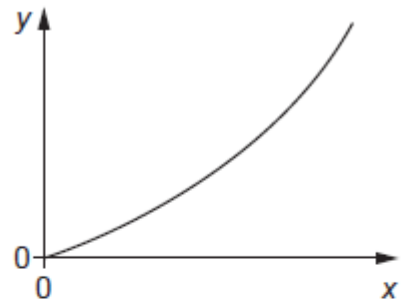
[1]

16. An object falls freely from rest.

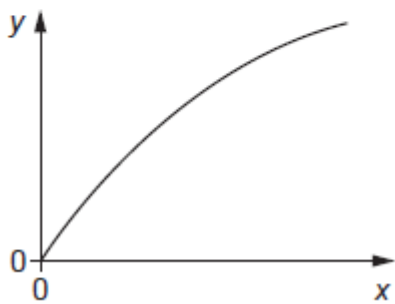
Which graph represents distance fallen (y -axis) against time (x -axis)?



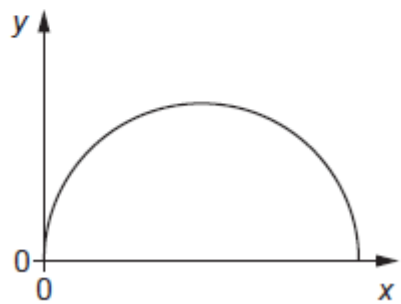
A



B



C



D

Your answer

[1]

17. Light of wavelength 650 nm is incident at right angles on a diffraction grating with 300 lines per mm.

What is the angle of the third-order maximum?

A 4°

B 11°

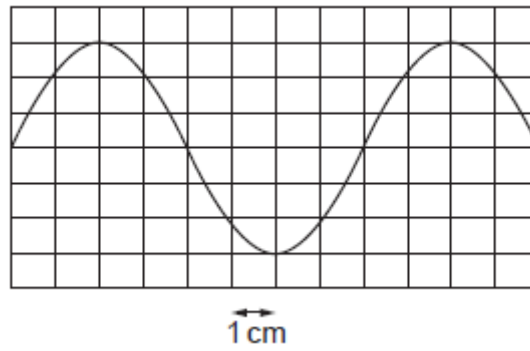
C 34°

D 36°

Your answer

[1]

18. The oscilloscope trace shows the variation in p.d of a signal. The time base of the oscilloscope is set at 0.25 ms cm^{-1} .



What is the frequency of the signal?

- A 333 Hz
- B 500 Hz
- C 1000 Hz
- D 5000 Hz

Your answer

[1]

19. The power of a beam of light is 3.5 mW. The wavelength is 445 nm.

How many photons are emitted each second?

- A 8×10^{15}
- B 8×10^{18}
- C 8×10^{21}
- D 8×10^{24}

Your answer

[1]

20. A ball of mass 0.12 kg falls vertically from rest and bounces. The collision with the ground is **elastic**, so kinetic energy is conserved. The duration of the collision is 0.040 s , and the ball leaves the ground with a speed of 10 m s^{-1} .

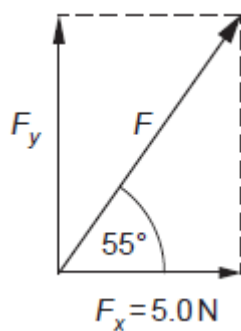
What is the average resultant force on the ball while it is in contact with the ground?

- A 0 N
- B 1.2 N
- C 30 N
- D 60 N

Your answer

[1]

21. A force vector, F , is resolved into a vertical component F_y and a horizontal component F_x . The diagram is not to scale.



What is the magnitude of F_y ?

- A 2.9 N
- B 3.5 N
- C 7.1 N
- D 8.7 N

Your answer

[1]

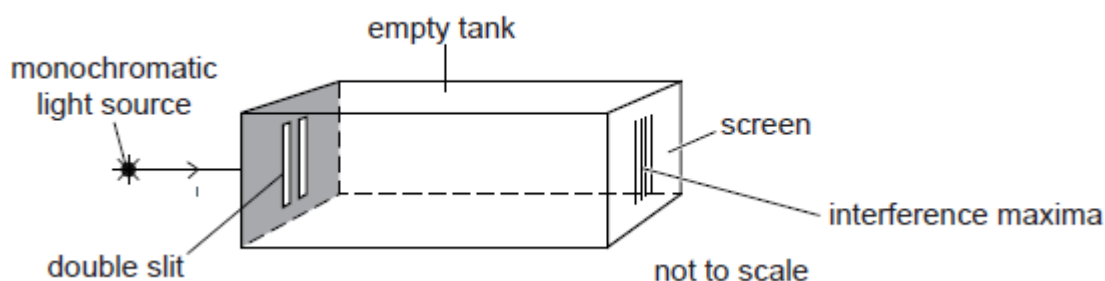
22. The de Broglie wavelength of an electron with kinetic energy 900 eV is 4.1×10^{-11} m. What is the wavelength of an electron with kinetic energy 450 eV?

- A 2.0×10^{-11} m
- B 2.9×10^{-11} m
- C 5.8×10^{-11} m
- D 8.2×10^{-11} m

Your answer

[1]

23. This experiment produces an interference pattern on the screen.



The tank is filled with water, and the maxima become closer together. Which statement correctly explains this observation in terms of the behaviour of light inside the tank?

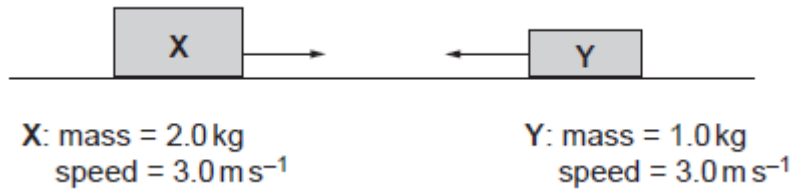
- A The refractive index of the water is lower than that of air.
- B The wavelength of the light has decreased.
- C The time taken for the light to travel from the slits to the screen has decreased.
- D The light waves from the slits are no longer coherent.

Your answer

[1]

The following information is for use in questions 24 and 25.

Two moving objects, X and Y collide and then move off together.



24. What is the total initial kinetic energy (E_k) and momentum (p) of X and Y?

	total initial E_k	total initial p
A	4.5 J	3 Ns
B	4.5 J	9 Ns
C	13.5 J	3 Ns
D	13.5 J	9 Ns

Your answer

[1]

25. What is the total final kinetic energy (E_k) and momentum (p) of X and Y, as they move off together?

	total final E_k	total final p
A	1.5 J	3 Ns
B	1.5 J	9 Ns
C	4.5 J	3 Ns
D	4.5 J	9 Ns

Your answer

[1]

26. A paintball is fired from a gun 1.8 m above the ground at a velocity of 75 m s^{-1} horizontally.

Ignore the effect of air resistance.

How long will the paintball take to hit the ground?

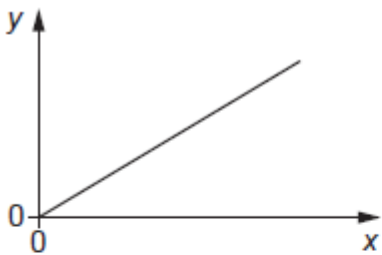
- A 0.012 s
- B 0.61 s
- C 15 s
- D 31 s

Your answer

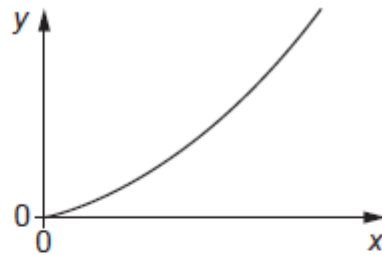
[1]

27. A large object falls vertically through the atmosphere. Write down the letter of the graph that would be obtained by plotting:

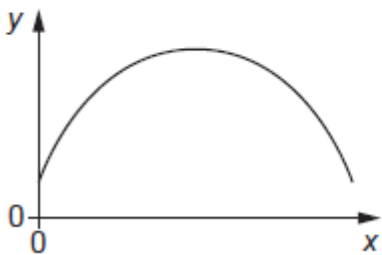
- velocity v of the object on the y -axis;
- distance d fallen on the x -axis.



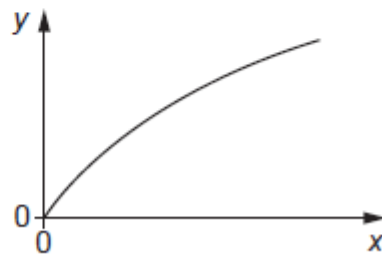
A



B



C



D

Your answer

[1]

28. A ball of momentum X collides with an identical stationary ball.

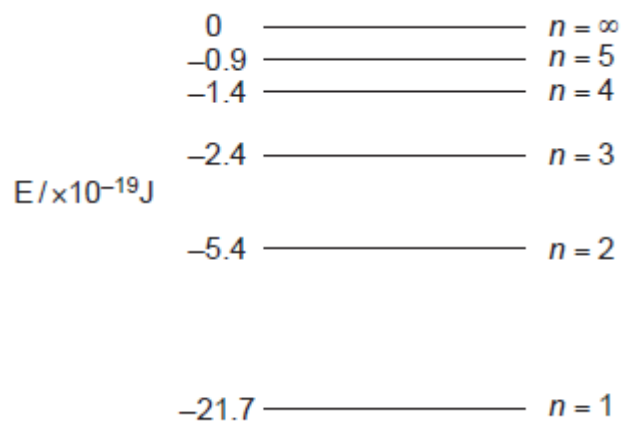
All of the kinetic energy of the first ball is transferred to the second ball. The change in momentum of the second ball is

- A $-2X$
- B $-X$
- C X
- D $2X$

Your answer

[1]

29. The diagram shows the energy levels in an atom.



An electron moves from $n = 3$ to $n = 2$. The frequency of the emitted light is

- A $1.5 \times 10^{14} \text{ Hz}$
- B $4.1 \times 10^{14} \text{ Hz}$
- C $4.5 \times 10^{14} \text{ Hz}$
- D $2.5 \times 10^{15} \text{ Hz}$

Your answer

[1]

30. A sensor is made up of 32×32 pixels.

In one experiment:

- a source emits 4096 photons, all of which are detected by the sensor;
- the probability of arrival of a photon is the same for each pixel.

The expected number of photons detected in each pixel is

- A** 1
- B** 4
- C** 128
- D** 4096

Your answer

[1]

31. A source emits ultraviolet light of wavelength 200 nm.

The power emitted by the source is 100 mW.

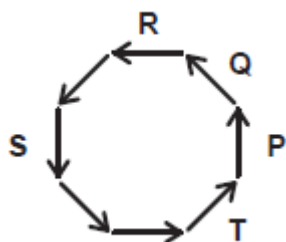
The number of photons emitted by the source in 1 s is of order

- A** 10^9
- B** 10^{12}
- C** 10^{14}
- D** 10^{17}

Your answer

[1]

32. The diagram shows a number of phasors.



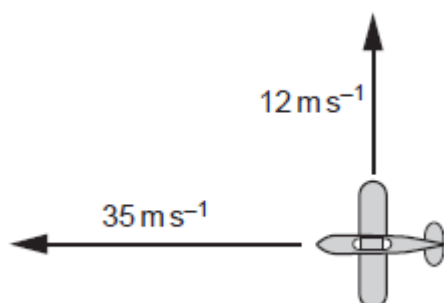
The two phasors with a phase difference of π radians are

- A P and R
- B P and S
- C Q and T
- D S and R

Your answer

[1]

33. An aircraft is flying with a velocity of 35 m s^{-1} westwards, relative to the air. A wind from the south pushes the aircraft northwards at a velocity of 12 m s^{-1} .



What is the magnitude of the resultant velocity of the aircraft, relative to the ground?

- A 23 m s^{-1}
- B 37 m s^{-1}
- C 47 m s^{-1}
- D 169 m s^{-1}

Your answer

[1]

34. Two moving bodies, X and Y, collide and then move off together.



Mass of X = 3.0 kg

Speed of X = 3.0 m s⁻¹

Mass of Y = 4.0 kg

Speed of Y = 2.0 m s⁻¹

What is the speed of the combined body after the collision?

A 0.14 m s⁻¹

B 1.5 m s⁻¹

C 2.4 m s⁻¹

D 5.0 m s⁻¹

Your answer

[1]

35. What is the de Broglie wavelength of an electron accelerated from rest through a p.d. of 0.90 kV?

A 4.1×10^{-11} m

B 5.8×10^{-11} m

C 1.4×10^{-9} m

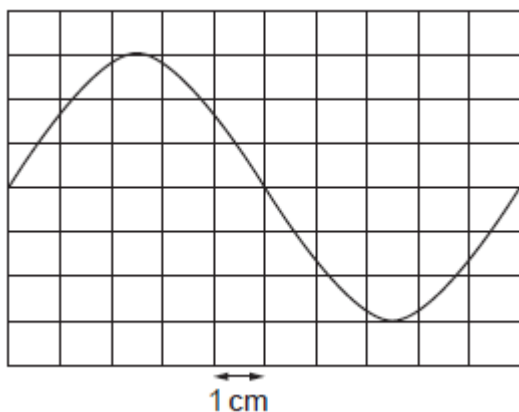
D 1.8×10^{-9} m

Your answer

[1]

36. The diagram shows an oscilloscope trace of the p.d. from a signal generator.

The time base of the oscilloscope is set to 0.50 ms cm^{-1} .



What is the frequency of the signal shown?

- A 0.2 Hz
- B 5 Hz
- C 200 Hz
- D 2000 Hz

Your answer

[1]

Total marks for Question Set 2: 36

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