OCR
Oxford Cambridge and RSA

A level Physics B

H557/01 Fundamentals of physics

Question Set 2 (Module 4 MCQs)

1 Which pair contains one vector and one scalar quantity?

A	velocity	acceleration
B	displacement	force
C	kinetic energy	work done
D	momentum	distance

[1]

2 Electrons accelerated through a potential difference V pass through a thin layer of graphite. The beam forms a diffraction pattern of rings on a fluorescent screen.
When V is made larger the diameter of the rings get smaller and they also become brighter.

Which **one** of the following statements about this experiment is correct?

A The power delivered to the fluorescent screen decreases as V increases.

B The diameter of the diffraction rings is independent of the interatomic spacings in graphite.

C The wavelength of the electrons decreases as their kinetic energy increases.

D The momentum of the electrons decreases as V increases.

[1]

3 Which **one** of the following statements about photons is correct?

The probability of arrival of a photon at a position

A is proportional to the amplitude of the waves arriving at that position.

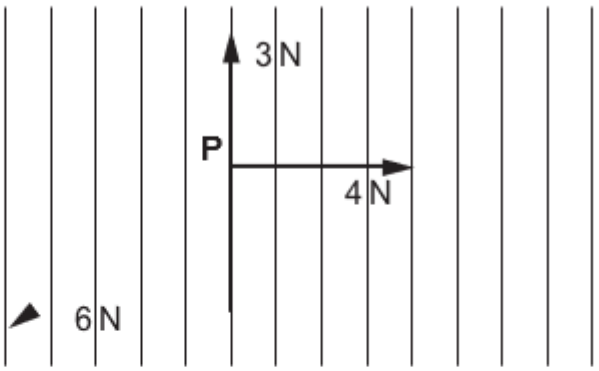
B is greater if the phasor amplitudes for paths from the source to that position "curl up" when they are added.

C is proportional to the (resultant phasor amplitude)^2 for all photon paths from the source to that position.

D is proportional to the phasor amplitude for the photon path straight from the source to that position.

[1]

4 The three forces in this vector diagram act in one plane on an object **P**.



What is the magnitude and direction of the resultant?

A 1 N ↙

B 1 N ↗

C 1 N →

D 11 N ↙

[1]

5 A car travelling at 10 m s^{-1} is brought to rest in a braking distance of 10 m.

Using the same average braking force, in what distance can the car be brought to rest from a speed of 40 m s^{-1}?

A 20 m

B 40 m

C 80 m

D 160 m

[1]

6 The drag force F of the air on a train is

$$F \approx 10v^2$$

where F is in newtons and the speed v is in $m\,s^{-1}$.

What **power** must be delivered by the engine to keep the train travelling at a constant $50\,m\,s^{-1}$?

A 25 kW

B 125 kW

C 1.25 MW

D 2.5 MW

[1]

7 Which of the following statements about the α-particle and the β-particle is correct?

A If both have the same kinetic energy, the speed of the β-particle is less than that of the α-particle.

B If both have the same momentum, the de Broglie wavelength of the α-particle must be the same as that of the β-particle.

C If both have the same momentum, the kinetic energy of the α-particle is greater than that of the β-particle.

D The rest energies of both the α-particle and the β-particle are the same.

[1]

8 Which expression gives a quantity that can be expressed in joules?

A $F\,v$ where F is the force causing a body to move and v is its speed

B $I^2\,R$ where I is the current flowing through a resistance of value R

C $m\,v$ where m is the mass of a body moving with velocity v

D $V\,I\,t$ where V is the potential difference across a conductor and I is the current in it for time t.

[1]

9 A boat travels eastwards with a velocity of $12\,m\,s^{-1}$.
A current from the south pushes the boat northwards at a velocity of $5\,m\,s^{-1}$.

What is the magnitude of the resultant velocity of the boat?

A $7\,m\,s^{-1}$

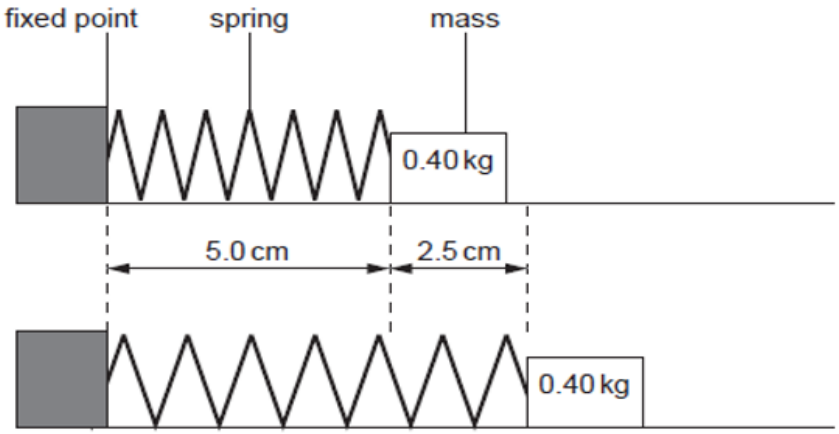
B $13\,m\,s^{-1}$

C $17\,m\,s^{-1}$

D $169\,m\,s^{-1}$

[1]

10 The spring in this diagram has a spring constant of $20\,N\,m^{-1}$.
The mass is pulled away from the fixed point. The spring stretches by 2.5 cm.
The mass is then released.



What is the maximum speed reached by the mass?

A $0.18\,m\,s^{-1}$

B $0.53\,m\,s^{-1}$

C $1.25\,m\,s^{-1}$

D $3.75\,m\,s^{-1}$

[1]

11 An electron is travelling at a speed of $3.1 \times 10^5\,m\,s^{-1}$.

What is its kinetic energy in electronvolts?

A $4.4 \times 10^{-20}\,eV$

B $8.8 \times 10^{-7}\,eV$

C $0.27\,eV$

D $500\,eV$

[1]

12 A ball is kicked from horizontal ground at a velocity of $15\,m\,s^{-1}$ at an angle of 20° to the horizontal.

How long will the ball remain in the air before hitting the ground?
Ignore any effects of air resistance.

A 0.5 s

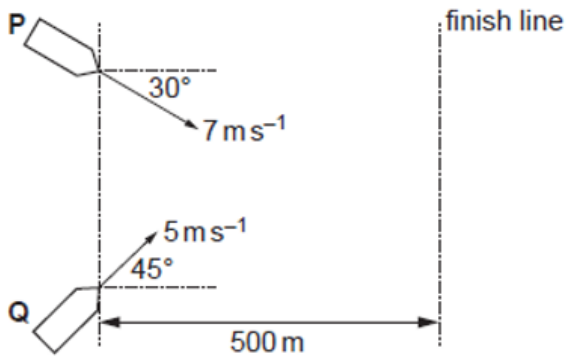
B 1.0 s

C 1.4 s

D 2.9 s

[1]

13 The diagram shows two boats **P** and **Q** sailing at constant velocity towards the finish line.



Which statement is correct?

A Boat **P** wins by 1.4 s.

B Boat **Q** wins by 29 s.

C Boat **P** wins by 59 s.

D Boat **Q** wins by 198 s.

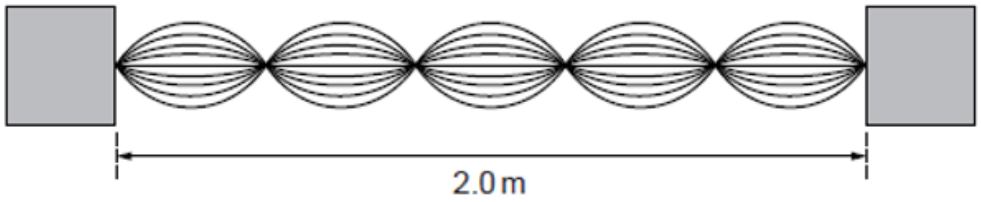
[1]

14 Which quantity is followed by a reasonable estimate of its order of magnitude?

A	momentum of a bee in flight	$10^0\,\text{kg m s}^{-1}$
B	speed of an air molecule at room temperature	$10^6\,\text{m s}^{-1}$
C	wavelength of red light	$10^{-6}\,\text{m}$
D	wavelength of X-rays	$10^{-15}\,\text{m}$

[1]

15 The diagram shows a sketch of a wave pattern on a vibrating string.



Which description of this wave is correct?

A The wave is longitudinal, has a wavelength of 40 cm and is stationary.

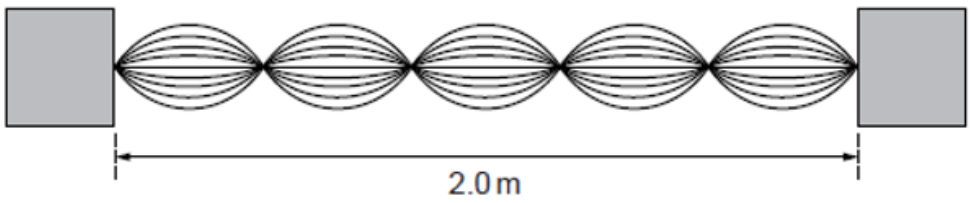
B The wave is transverse, has a wavelength of 40 cm and is stationary.

C The wave is transverse, has a wavelength of 80 cm and is progressive.

D The wave is transverse, has a wavelength of 80 cm and is stationary.

[1]

16 The diagram shows a sketch of a wave pattern on a vibrating string.



The frequency of the wave shown in the diagram is 3.0 Hz.

What is the wave speed on the string?

A $1.2\,\text{m s}^{-1}$

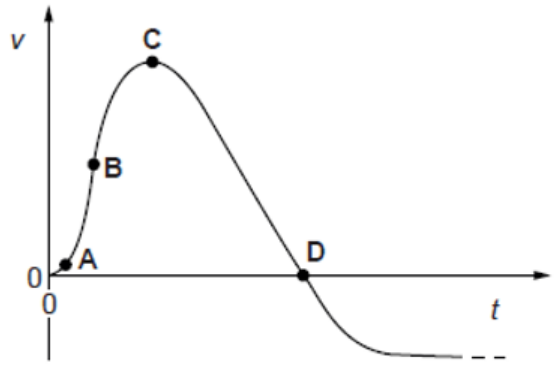
B $2.4\,\text{m s}^{-1}$

C $3.8\,\text{m s}^{-1}$

D $7.5\,\text{m s}^{-1}$

[1]

17

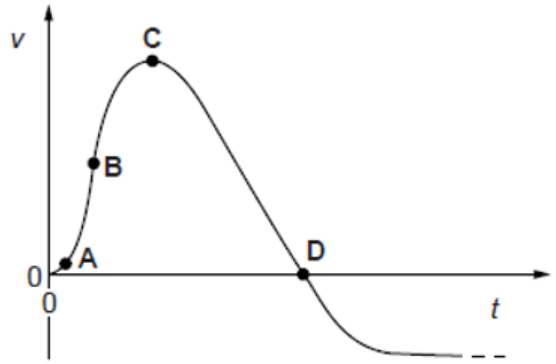


The graph shows how the vertical velocity *v* of a firework rocket changes with time *t*.

At which point labelled on the graph does the rocket have the greatest acceleration?

[1]

18



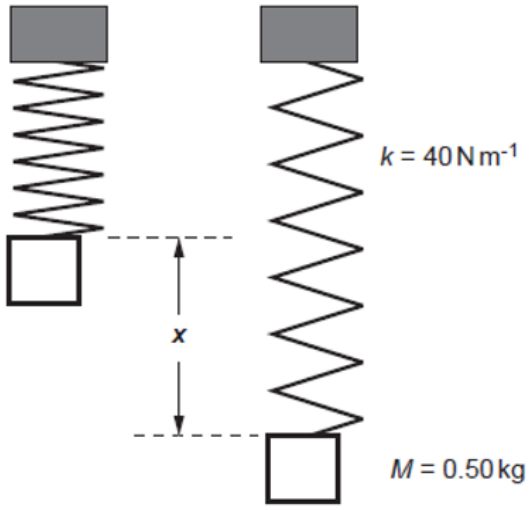
The graph shows how the vertical velocity *v* of a firework rocket changes with time *t*.

At which point labelled on the graph does the rocket have the greatest altitude?

[1]

19 The spring in this diagram has a spring constant k of $40\,N\,m^{-1}$.
The mass M of 0.50 kg is attached to the end of the suspended spring and then dropped under gravity.

acceleration due to gravity $g = 10\,m\,s^{-2}$



What is the maximum extension x of the spring in metres when the mass first comes to rest?

(Use ideas about energy conservation.)

A $\frac{1}{8}$

B $\frac{1}{4}$

C $\frac{1}{2}$

D 1

[1]

20 A beam of α-particles collides with a lead sheet and is absorbed.
Each α-particle in the beam has a mass of 7×10^{-27} kg and a speed of 1×10^{7} m s^{-1}.
3×10^{3} α-particles per second collide with an area of $1 \times 10^{-4}\,m^2$ of lead.

What is the best estimate of the average pressure exerted on the lead by the α-particles?

A 2×10^{-20} Pa

B 2×10^{-16} Pa

C 2×10^{-12} Pa

D 2×10^{-8} Pa

[1]

Total Marks for Question Set 2: 20