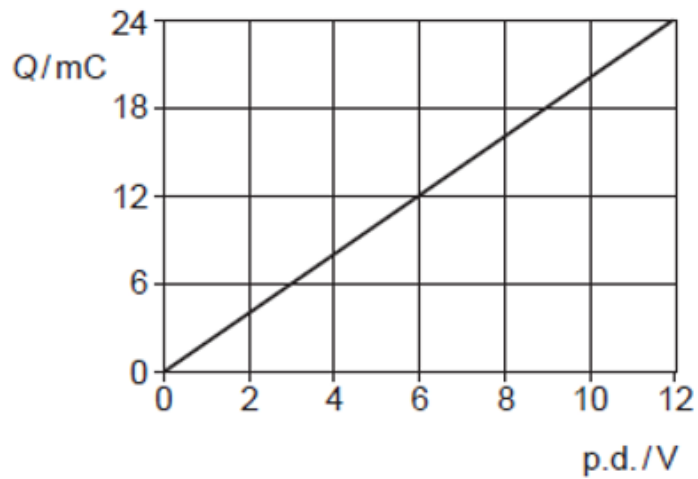


A level Physics B

H557/01 Fundamentals of physics

Question Set 3 (Module 5 MCQs)

- 1 The diagram shows the $Q - V$ graph for a capacitor charged to 12 V.

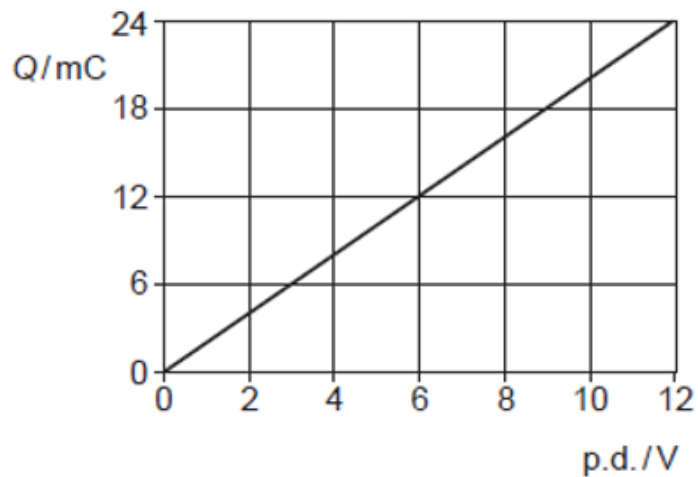


What is the capacitance?

- A $2 \times 10^{-3} \text{F}$
- B $144 \times 10^{-3} \text{F}$
- C $288 \times 10^{-3} \text{F}$
- D 500 F

[1]

- 2 The diagram shows the $Q - V$ graph for a capacitor charged to 12 V.



Which of the following is the energy stored?

- A $2 \times 10^{-3} \text{J}$
- B $144 \times 10^{-3} \text{J}$
- C $288 \times 10^{-3} \text{J}$
- D 500 J

[1]

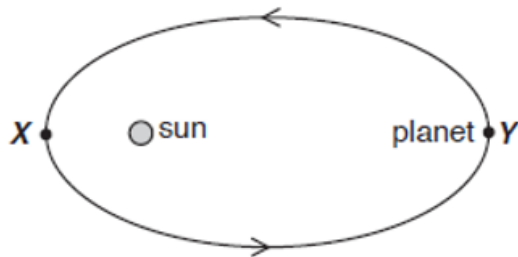
- 3 Suppose that a particular radioactive nucleus is observed for a period of time to find when it decays.
The isotope's half-life is 1 hour, and after 1 hour the particular nucleus has **not** decayed.

The chance that it will decay in the next second

- A cannot be stated because the chance varies randomly from second to second.
- B is now half the chance that it had to decay in the first second.
- C is just the same as the chance that it would have decayed in the first second or any other second.
- D is the same as the chance that it will not decay in the next second.

[1]

- 4 A planet is in elliptical orbit around the Sun as shown.

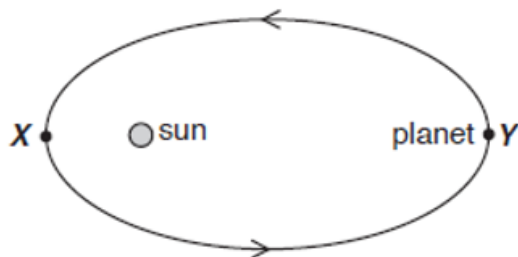


Which of the following is correct?

- A As the planet leaves X it is speeding up.
- B As the planet approaches X it is slowing down.
- C As the planet approaches Y it is speeding up.
- D As the planet leaves Y it is speeding up.

[1]

- 5 A planet is in elliptical orbit around the Sun as shown.



Which of the following quantities is **greater** at Y than at X?

- A the gravitational force on the planet from the sun
- B the gravitational potential energy of the planet-sun system
- C the kinetic energy of the planet in its orbit
- D the total energy of the planet-sun system

[1]

6 Two samples **L** and **M** contain the same mass of an ideal gas.

In which of the following cases will it always be true that the molecules in **L** have a larger root mean square speed than those in **M**?

- 1 **L** is at a greater temperature than **M**
- 2 **L** has a greater volume than **M**
- 3 **L** is at a greater pressure than **M**

- A 1, 2 and 3 are correct
- B only 1 and 2 are correct
- C only 2 and 3 are correct
- D only 1 is correct

[1]

7 At 300 K a process has an activation energy $E = 10kT$.

The temperature is raised to 330 K.

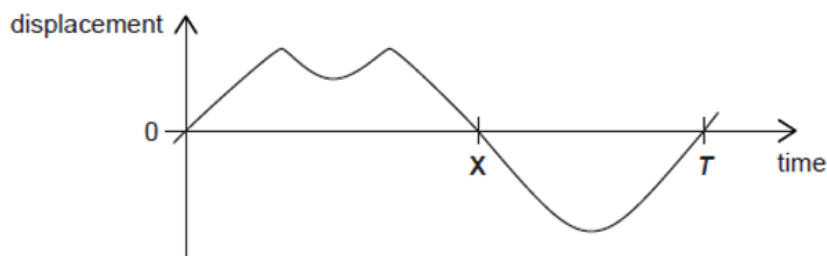
Which statement about the rate of the process is correct?

It will increase by

- A 10% because temperature has increased by 10%.
- B 10% because the mean square speed of the particles has increased by 10%.
- C 9.1 times because $\frac{E}{kT} = \frac{3000k}{330k} = 9.1$.
- D 2.5 times because $e^{\frac{-E}{kT}}$ has increased by $\frac{e^{-9.1}}{e^{-10}} = 2.5$ times.

[1]

8 The graph shows the displacement of a body which is oscillating periodically with time period T .



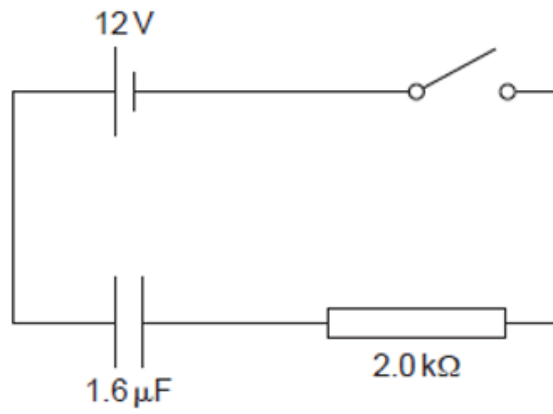
Which statement is correct?

- A The acceleration is zero at time **X**.
- B The body is performing simple harmonic motion.
- C In each cycle the velocity is zero three times.
- D The body changes direction at **X**.

[1]

9

An uncharged capacitor and a resistor are connected in this circuit.



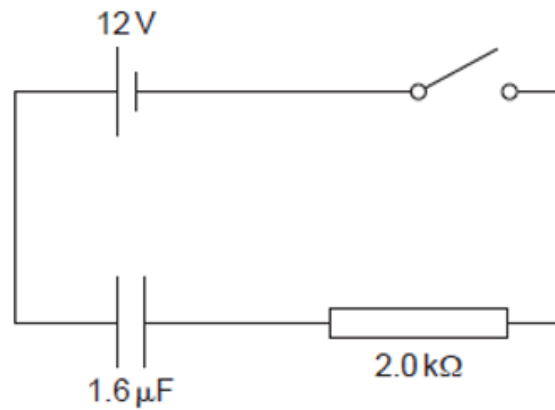
	current/mA	p.d. across the capacitor/V	p.d. across the resistor/V
A	0	12	0
B	2	8	4
C	3	6	6
D	6	0	12

Which set of values **A** to **D** above, most closely represents the situation immediately after the switch is closed?

[1]

10

An uncharged capacitor and a resistor are connected in this circuit.



	current/mA	p.d. across the capacitor/V	p.d. across the resistor/V
A	0	12	0
B	2	8	4
C	3	6	6
D	6	0	12

Which set of values **A** to **D** above, most closely represents the situation 3 seconds after the switch is closed?

[1]

11

A liquid flows through a tube containing an electrical heater with a constant voltage. At a steady state of flow, the liquid leaves the tube at temperature $\Delta\theta$ higher than the liquid entering.

Which change will increase $\Delta\theta$ with no other changes?

- A** Increasing the flow rate of the liquid.
- B** Changing the liquid to one with a higher specific heat capacity.
- C** Using a heating element of lower resistance.
- D** Decreasing the supply voltage.

[1]

12

This table shows the half-lives of three radioactive isotopes.

Isotope	$^{60}\text{cobalt}$	$^{192}\text{iridium}$	$^{210}\text{thallium}$
Half-life	5.3 years	74 days	1.8 minutes

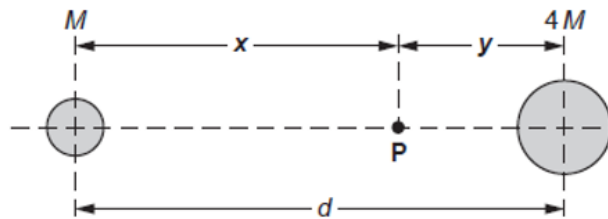
Which statement can be deduced from the information given?

- A The decay constant of thallium is smaller than that of iridium.
- B Because of the difference in half-lives, the energy of the particles emitted from cobalt must be less than the energy of the particles emitted by thallium.
- C The most active source will be thallium.
- D If the number of atoms in the cobalt and iridium sources is initially equal, then the iridium source will have the greater initial activity.

[1]

13

Two stars of mass M and $4M$ are a distance d apart. They orbit around their common centre of mass.



The point P , on the line between the centres of the stars, divides the distance d in the ratio $x : y$ as shown.

If P is the gravitational neutral point between the stars, which ratio is correct for $x : y$?

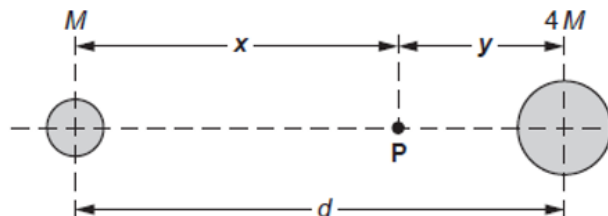
- A 1 : 4
- B 1 : 2
- C 2 : 1
- D 4 : 1

Your answer

[1]

14

Two stars of mass M and $4M$ are a distance d apart. They orbit around their common centre of mass.



The point P , on the line between the centres of the stars, divides the distance d in the ratio $x : y$ as shown.

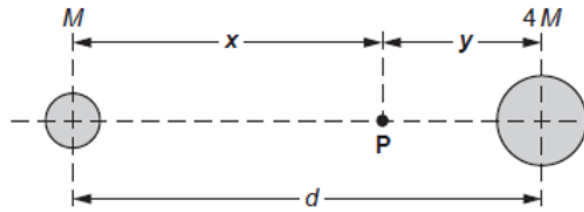
If P is the centre of mass of the two stars, which ratio is correct for $x : y$?

- A 1 : 4
- B 1 : 2
- C 2 : 1
- D 4 : 1

[1]

15

Two stars of mass M and $4M$ are a distance d apart.
They orbit around their common centre of mass.



The point P , on the line between the centres of the stars, divides the distance d in the ratio $x : y$ as shown.

If P is the point where the gravitational potentials of the two stars are equal, which ratio is correct for $x : y$?

- A 1 : 4 B 1 : 2 C 2 : 1 D 4 : 1

[1]

16

The relativistic factor $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$

Which statement about this factor is correct?

- A At the speed of sound γ is close to zero.
 B $\gamma \rightarrow 1$ as $v \rightarrow c$.
 C γ predicts the time dilation factor so that moving clocks run slower as $v \rightarrow c$.
 D γ^2 is the factor by which the total energy of a moving particle is greater than its rest energy.

[1]

17

A fixed mass of gas occupies a volume V . The temperature of the gas is increased so that the mean square speed of the molecules is doubled.

What is the new volume of the gas, if the pressure remains constant?

- A $\frac{V}{2}$
 B $\frac{V}{\sqrt{2}}$
 C $2V$
 D $4V$

[1]

18

Two radioactive sources of equal mass are freshly prepared. One is ^{225}Ra , which has a half-life of 15 days. The other is ^{225}Ac , which has a half-life of 10 days.

After 30 days which ratio gives $\frac{\text{number of } ^{225}\text{Ra atoms remaining}}{\text{number of } ^{225}\text{Ac atoms remaining}}$?

- A $\frac{1}{2}$
- B $\frac{3}{4}$
- C $\frac{4}{3}$
- D 2

[1]

19

Two radioactive sources of equal mass are freshly prepared. One is ^{225}Ra , which has a half-life of 15 days. The other is ^{225}Ac , which has a half-life of 10 days.

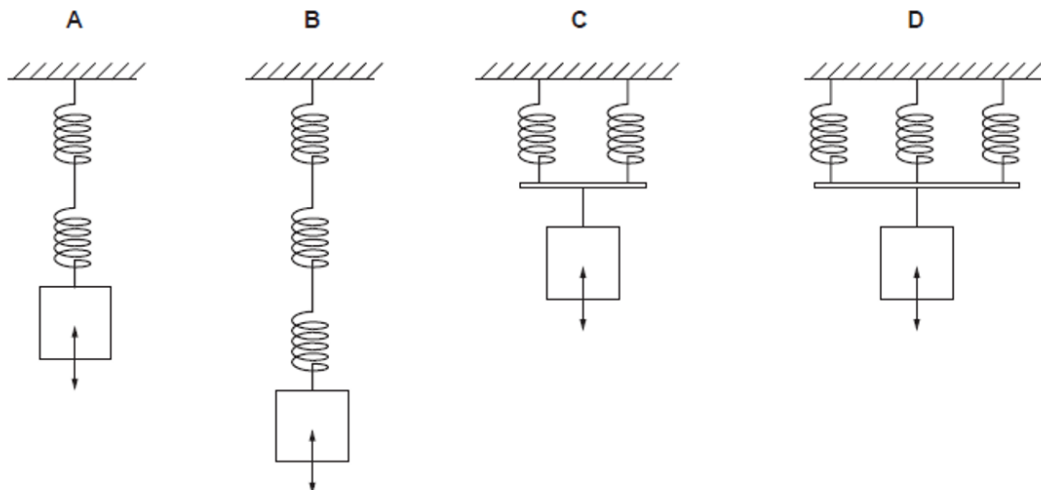
After 30 days which ratio gives $\frac{\text{activity of the } ^{225}\text{Ra source}}{\text{activity of the } ^{225}\text{Ac source}}$?

- A $\frac{1}{2}$
- B $\frac{3}{4}$
- C $\frac{4}{3}$
- D 2

[1]

20

The diagram shows a number of identical springs attached to identical masses joined in four different arrangements. Each spring constant is k and each mass is m .

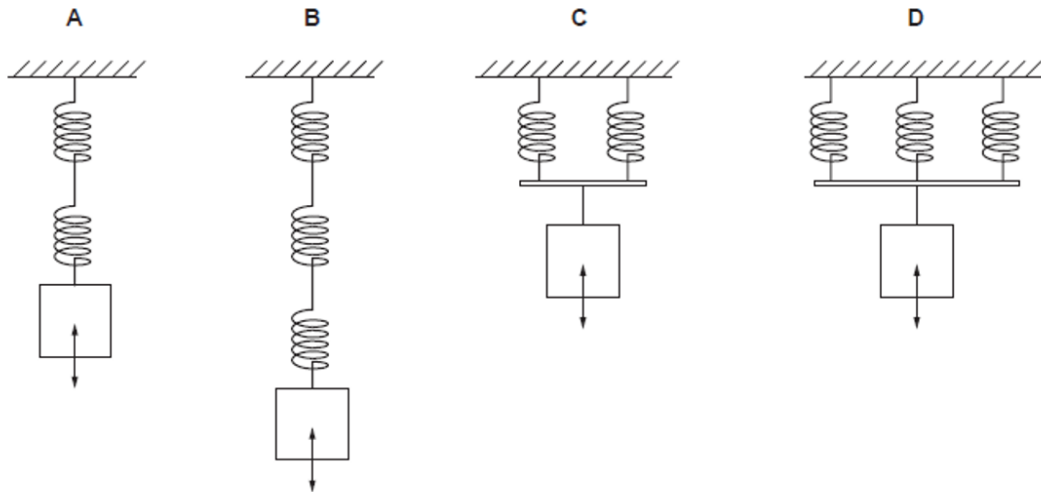


Which of the arrangements will give the simple harmonic oscillator of **lowest** frequency?

[1]

21

The diagram shows a number of identical springs attached to identical masses joined in four different arrangements. Each spring constant is k and each mass is m .



Which of the arrangements will give a simple harmonic oscillator whose frequency f is given by the following equation?

$$f = \frac{1}{2\pi} \sqrt{\frac{2k}{m}}$$

[1]

Total Marks for Question Set 3: 21

OCR

Oxford Cambridge and RSA

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge