IB · DP · Physics

30 mins | 30 questions

Practice Paper 1

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Total Marks /30

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1 A stone falls from rest to the bottom of a water well of depth d. The time t taken to fall is 3.0 ± 0.3 s. The depth of the well is calculated to be 30 m using $d = \frac{1}{2}at^2$. The uncertainty in a is negligible.

What is the absolute uncertainty in d?

A. ± 0.6 m

B. ± 3 m

C. ± 24 m

D. ± 6 m

(1 mark)

2 The units of all physical quantities can be expressed in terms of SI base units.

Which pair contains quantities with different base units?

A. emf and lost volts

B. mass per unit area and density

C. impulse and momentum

D. work and energy

(1 mark)

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3 A stone is released from a hot air balloon moving upwards with a uniform velocity of 25 m s^{-1}.

If the hot air balloon is 30 m high when the stone was dropped, what is its height when the stone hits the ground?

A. 180 m

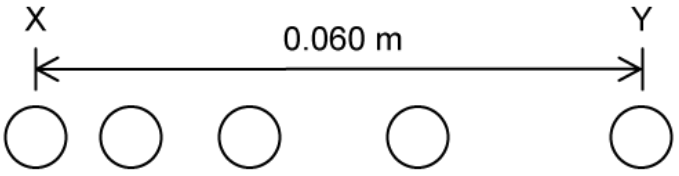
B. 55 m

C. 150 m

D. 60 m

(1 mark)

4 A ball starts from rest and moves horizontally. Five positions of the ball are shown at time intervals of 0.50 ms. The horizontal distance between X, the initial position, and Y, the final position, is 0.060 m.



What is the average acceleration of the ball between X and Y?

A. 48 m s^{-2}

B. 60 m s^{-2}

C. 19 200 m s^{-2}

D. 30 000 m s^{-2}

(1 mark)

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5 An object is released from a stationary hot air balloon at height *s* above the ground. Air resistance is negligible.

An identical object is released at the same height above the ground from another balloon that is rising at a constant speed.

Which of the following does not increase for the object released from the rising balloon?

A. The time taken for it to reach the ground

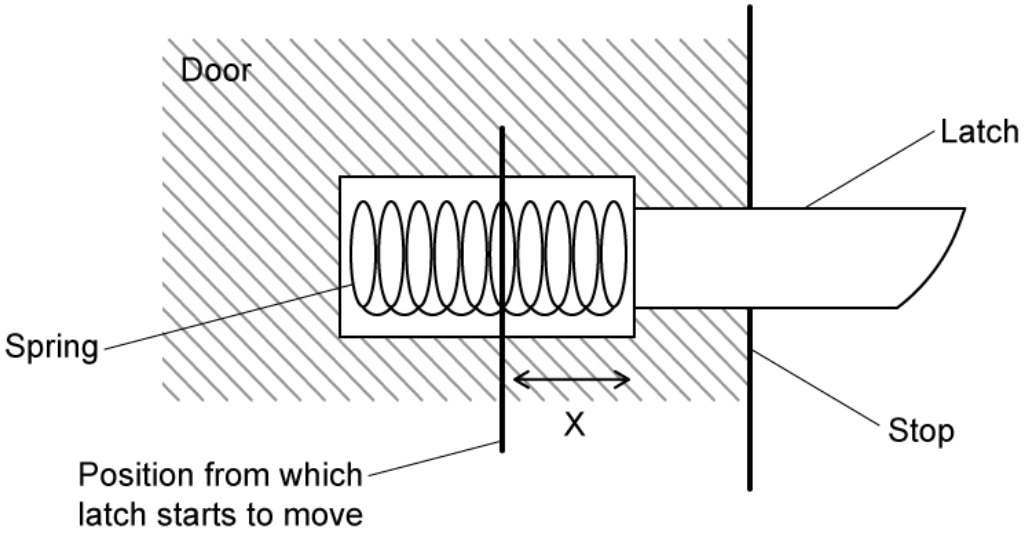
B. The distance through which it falls

C. Its acceleration

D. The speed with which it hits the ground

(1 mark)

6 A frictionless spring-operated latched is fitted to a door.



When the latch is pushed in, the spring compresses.

When the latch is released, which of the following best represents how acceleration *a* of the latch varies with the distance *x* it moves before stopping?

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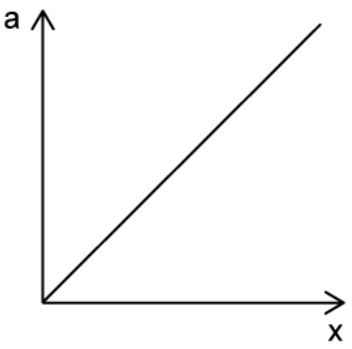
A.



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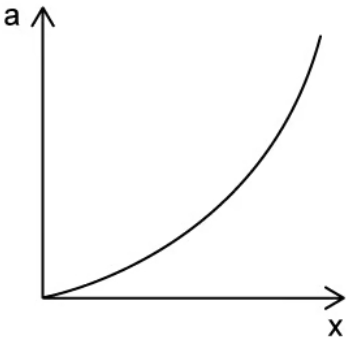

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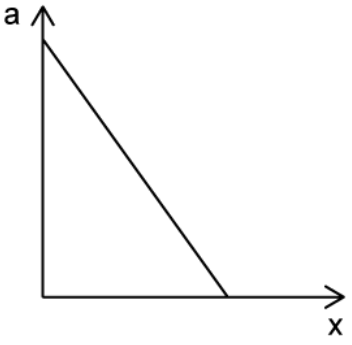

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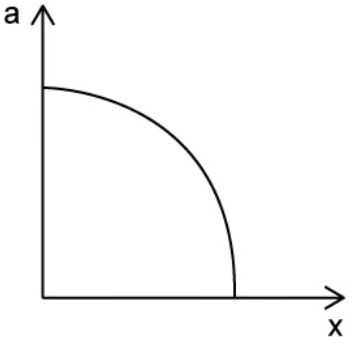

(1 mark)

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7 What is the definition of an external force?

A. Forces that act on a system from outside of it

B. Forces exchanged by the particles in a system

C. Every action has an equal and opposite reaction

D. The rate of change of momentum on a body

(1 mark)

8 Which of the following is true for momentum and impulse?

A. Momentum is conserved in an inelastic collision

B. Impulse is the momentum

C. The direction in which an object is travelling in doesn't affect its impulse

D. A heavier object always experiences a greater impulse than a lighter one

(1 mark)

9 A child whirls a conker on a string around their head. The conker moves with uniform circular motion. The linear speed of the conker is 5 m s^{-1} and the radius of the circle is 0.5 m.

Calculate the angular speed of the conker.

A. 2.5 rad s^{-1}

B. 0.5 rad s^{-1}

C. 10 rad s^{-1}

D. 5 rad s^{-1}

(1 mark)

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10 Liquid iron solidifies without a change in temperature.

Which of the following is correct for the molecules in the solid phase compared with molecules in the liquid phase?

	Potential energy	**Kinetic energy**
A.	same	same
B.	same	less
C.	less	less
D.	less	same

(1 mark)

11 The strength of intermolecular forces varies between in the different states of matter.

What is the order from highest to lowest strength of intermolecular forces?

A. solid > liquid > gas

B. solid > gas > liquid

C. liquid > gas > solid

D. gas > liquid > solid

(1 mark)

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12 A sealed cylinder contains water at 10 °C and ice at 0 °C. The system has been thermally isolated from the surroundings. The ice and the water reach thermal equilibrium.

What happens to the total internal energy of the system in order for equilibrium to be reached?

A. It reduces

B. It increases

C. It increases until the ice has melted and then remains constant

D. It remains constant

(1 mark)

13 A spring in a ball point pen has a mass of 0.10 g and a specific heat capacity of 400 J kg^{-1} K^{-1} and a spring constant k = 200 N m^{-1}. To open or close the nib of the pen the spring is compressed by 8 mm. Upon release 5% of the elastic potential energy stored is converted into heat energy in the spring.

How many times must the spring be compressed and released to cause the temperature of the pen to increase by 2 °C?

Assume that no heat is lost from the pen.

A. 250

B. 80 000

C. 250 000

D. 100

(1 mark)

14 Which of the following graphs shows the variation with displacement x of the speed v of a particle performing simple harmonic motion?

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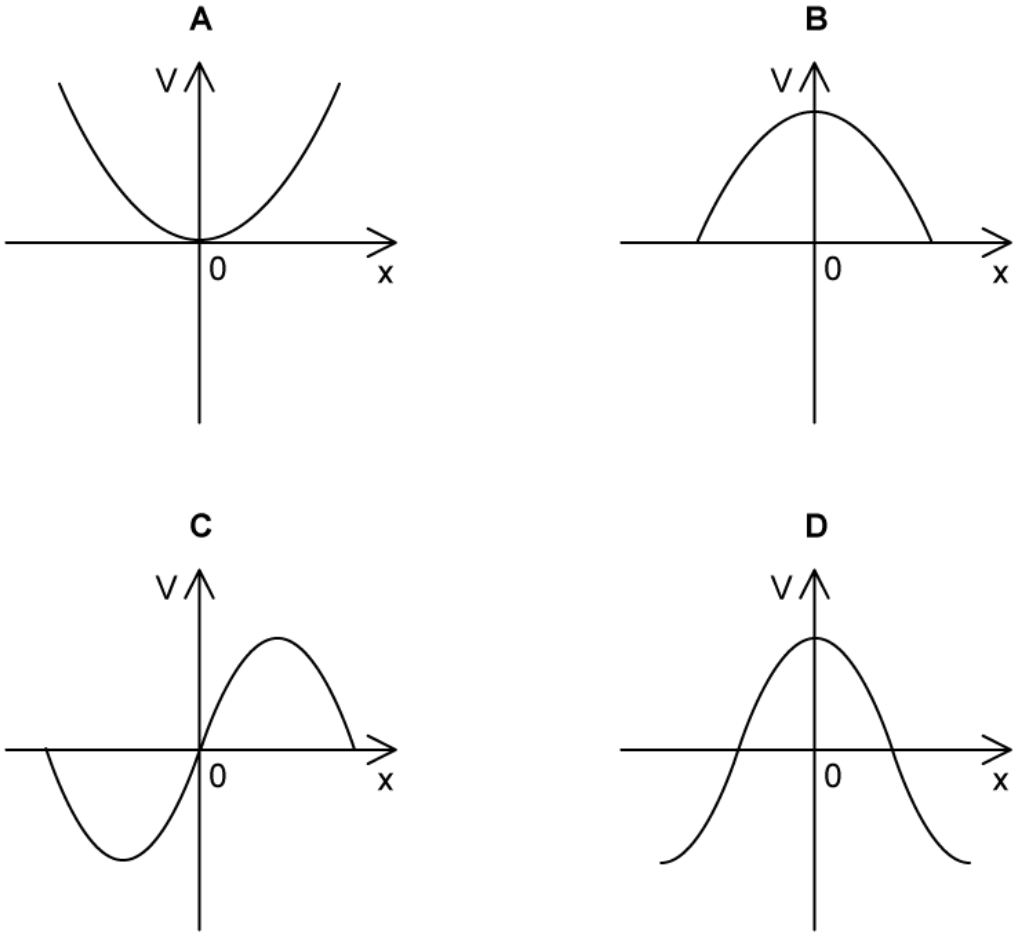

(1 mark)

15 A mass is attached to a spring from above and the spring is secured to a clamp. The mass is pulled down and released resulting in a simple harmonic oscillation.

Which one of the following statements is true?

A. The tension, T, in the spring is at a minimum as the mass passes through the equilibrium position

B. The total potential energy, E_P, in the system is at a maximum when the mass is at the highest point of its oscillation

C. The acceleration, a, of the mass is at a maximum as it passes through the equilibrium position

D. The kinetic energy, E_K, is at a minimum when the mass is at the lowest point in its oscillation

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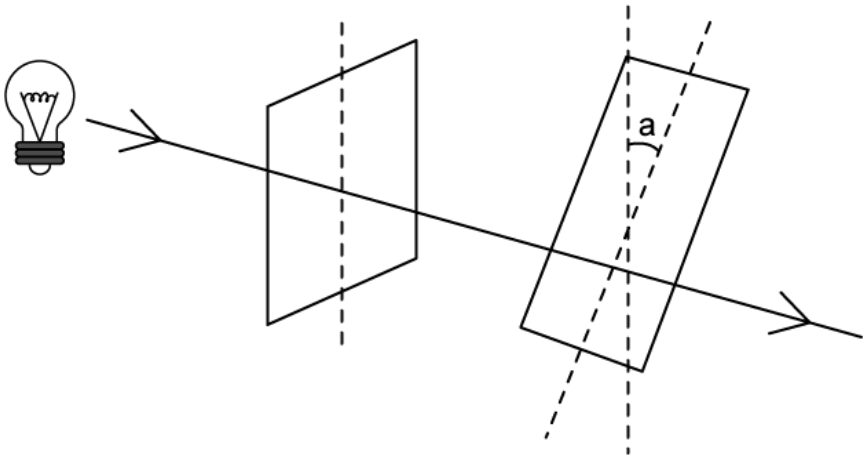
(1 mark)

16 When a light ray enters a denser medium and refracts, some of the characteristics of the wave will change. Which of the following options is correct about this change?

	Speed	Frequency	Wavelength
A	Increases	Decreases	Stays constant
B	Decreases	Stays constant	Decreases
C	Stays constant	Decreases	Increases
D	Increases	Increases	Stays constant

(1 mark)

17 An unpolarised electromagnetic wave passes through 2 polarisers. The second polariser is at a clockwise angle a to the vertical.



When a = 225 ° what percentage of the unpolarised light is transmitted through both filters?

A. 25%

B. 50%

C. 12.5%

D. 6.25%

(1 mark)

18 Two microwave transmitters are set up to emit microwaves so that a stationary wave is created between them. The microwaves have a frequency of 300 MHz.

Which line correctly gives both the formula which represents the the distance between two adjacent nodes in the standing wave and the value for the distance?

	Formula	Distance
A.	$\frac{c}{2f}$	50 cm
B.	$\frac{f}{2c}$	2.0 m
C.	$\frac{c}{2f}$	5.0 m
D.	$\frac{f}{2c}$	20 cm

(1 mark)

19 The double-slit equation describes the relationship between the separation distance of the fringes on the screen, *s*, the distance between the screen and the slits, *D*, the separation of the slits, *d*, and the wavelength, *λ,* of the light.

$$s = \frac{\lambda D}{d}$$

Which line gives the correct units for the quantities?

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	s	D	λ	d
A.	m	m	m	m
B.	m^{-1}	m	$m\ s^{-1}$	m
C.	m	$m\ s^{-1}$	m	m^{-1}
D.	m^2	m^{-1}	m	m

(1 mark)

20 The Tolman-Stewart experiment sought to find evidence that mobile charge carriers inside conducting metals are negatively charged.

It involved exploiting the inertia of 'free' charge carriers in the conductor. If the conductor was suddenly accelerated, a potential difference would be set up.

Assuming positive charges are fixed in place and mobile charge carriers are negative, which of the following statements about the Tolman-Stewart experiment is incorrect?

A. Accelerating the conductor created an area of excess negative charge in it

B. Accelerating the conductor created an area of excess positive charge in it

C. Electrons have inertia

D. The potential difference created by the acceleration was not measurable

(1 mark)

21 Five resistors of equal resistance are connected to a cell as shown.

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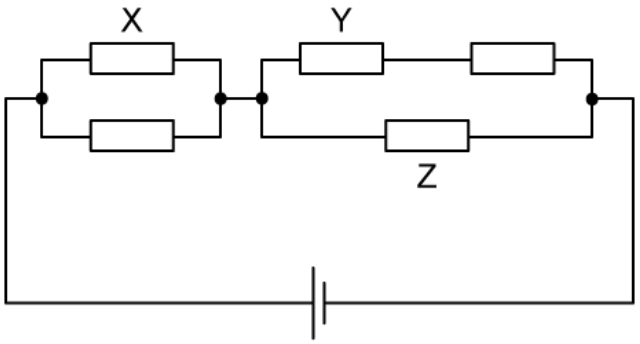

Which of the following is correct about the power dissipated P_X, P_Y and P_Z in resistors X, Y and Z respectively?

	P_X	P_Y	P_Z
A.	I^2R	$\frac{1}{3}I^2R$	$\frac{2}{3}I^2R$
B.	$\frac{1}{4}I^2R$	$\frac{1}{3}I^2R$	$\frac{4}{9}I^2R$
C.	I^2R	$\frac{1}{9}I^2R$	$\frac{2}{3}I^2R$
D.	$\frac{1}{4}I^2R$	$\frac{1}{9}I^2R$	$\frac{4}{9}I^2R$

(1 mark)

22 Which of the following correctly describes the electromotive force of a cell?

A. The difference in energy between that needed to drive unit charge through the load resistance and through the cell

B. The energy used to drive unit charge through the load resistance

C. The energy used to drive unit charge through the cell's internal resistance

D. The total energy used to drive unit charge round the complete circuit

(1 mark)

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23 A current of 3.0 mA flows in a wire of length 2.0 m. It is placed in a magnetic field of flux density 4 T such that the angle between the current and the field is 90°.

What is the magnitude of the magnetic force on the wire?

A. 0.012 N

B. 0.024 N

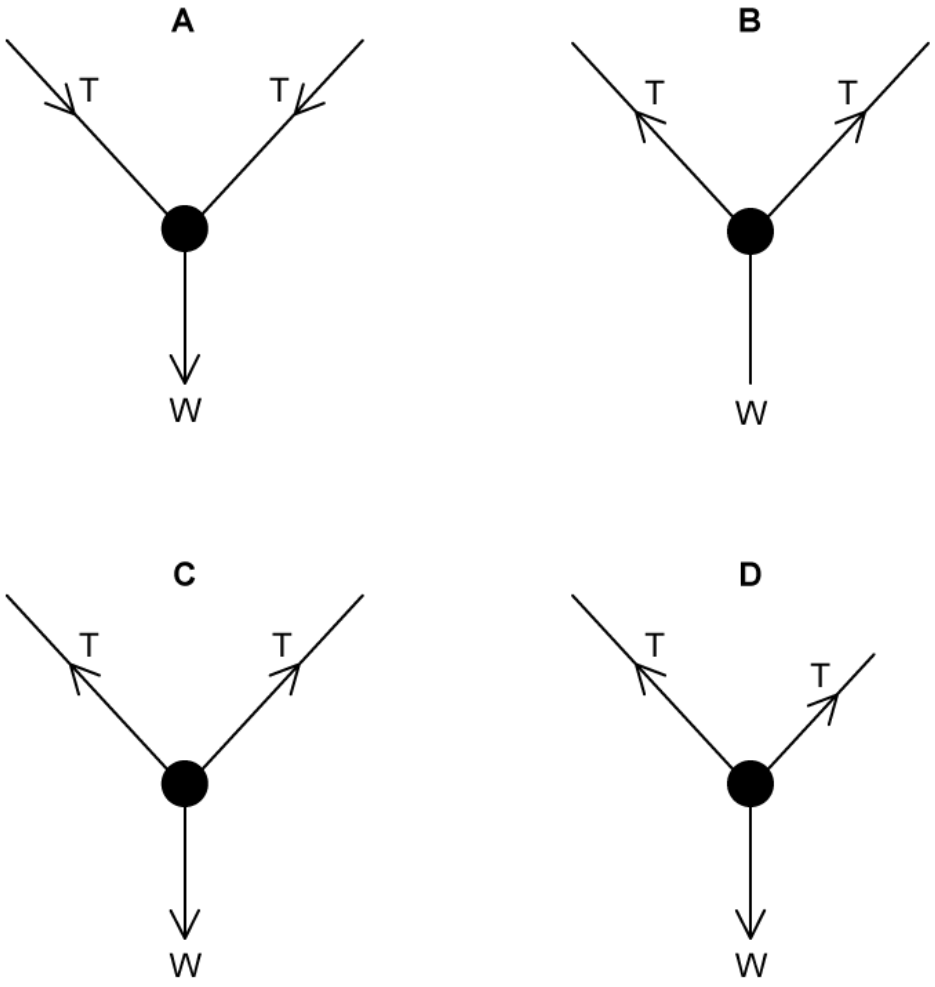
C. 8 N

D. 24 N

(1 mark)

24 A photo hangs from two strings. It has a weight *W* and the two strings have equal tension *T*.

What is the free–body diagram for this situation?



(1 mark)

25 A body moves in a circle with increasing angular velocity. At times t, the angles θ swept out by the body added cumulatively from the same reference point and its angular velocities ω are as follows:

t / s	θ / rad	ω / rad s^{-1}
5	2	0.4
15	16	2.4
25	42	4.4
35	80	6.4

The angular acceleration of the body:

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A. is constant at 0.2 rad s^{-2}

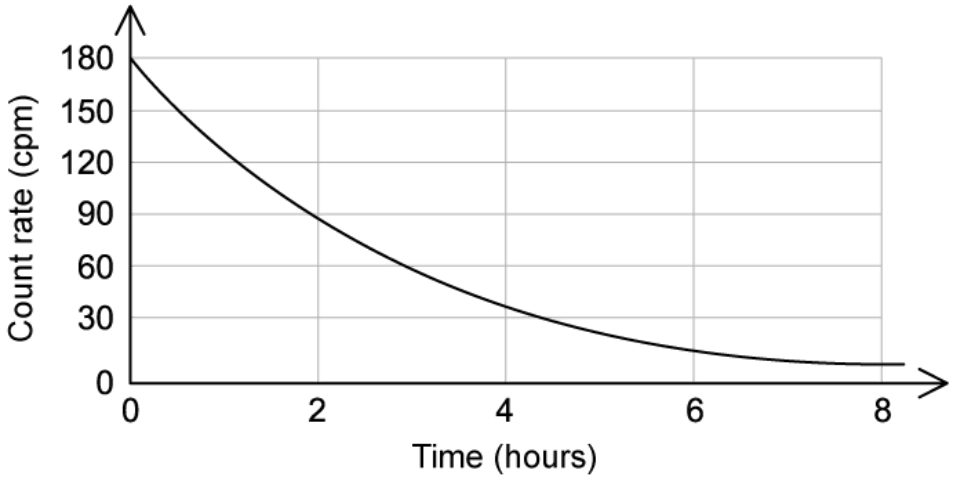
B. gradually decreases and is 6.25 rad s^{-2} when t = 15 s

C. is constant at 0.4 rad s^{-2}

D. increases at a constant rate and is 0.2 rad s^{-2} when t = 15 s

(1 mark)

26 Unstable nuclei make up 10% of a sample's mass. The count rate of the sample is measured over a time period of 8 hours.



After some time has passed, the percentage of the sample which is unstable reduces to 2.5%. What is the count rate of the source at this time?

A. 90 cpm

B. 60 cpm

C. 45 cpm

D. 30 cpm

(1 mark)

27 A stationary uranium-238 nucleus decays by alpha-emission, as shown in the equation below:

$$^{238}_{92}\mathrm{U} \rightarrow {}^{234}_{90}\mathrm{Th} + {}^{4}_{2}\alpha$$

This decay generates a total energy *E*.

Which of the following statements is correct regarding the kinetic energy of the alpha particle?

A. It is slightly less than 0.5*E*

B. It is equal to *E*

C. It is slightly greater than 0.5*E*

D. It is slightly less than *E*

(1 mark)

28 The diagram shows the decay chain for a particular isotope.

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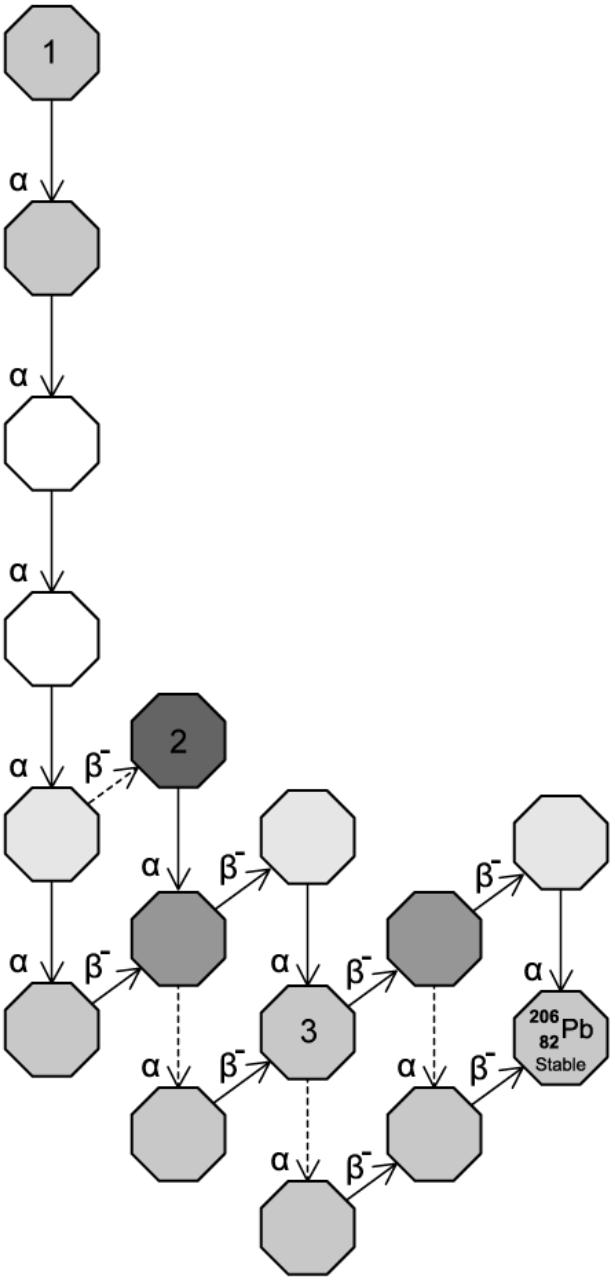

What are the isotopes labelled 1, 2 and 3?

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	1	2	3
A	$^{230}_{90}Th$	$^{218}_{85}At$	$^{210}_{82}Pb$
B	$^{234}_{92}U$	$^{218}_{85}At$	$^{210}_{82}Pb$
C	$^{234}_{92}U$	$^{218}_{84}Po$	$^{210}_{81}Tl$
D	$^{230}_{90}Th$	$^{218}_{84}Po$	$^{210}_{82}Pb$

(1 mark)

29 A liquid is initially at its boiling point. Energy is continuously supplied to the liquid at a uniform rate until it has completely evaporated.

Which graph shows how the temperature of the liquid, *T*, varies with the energy, *Q*, supplied to the liquid?

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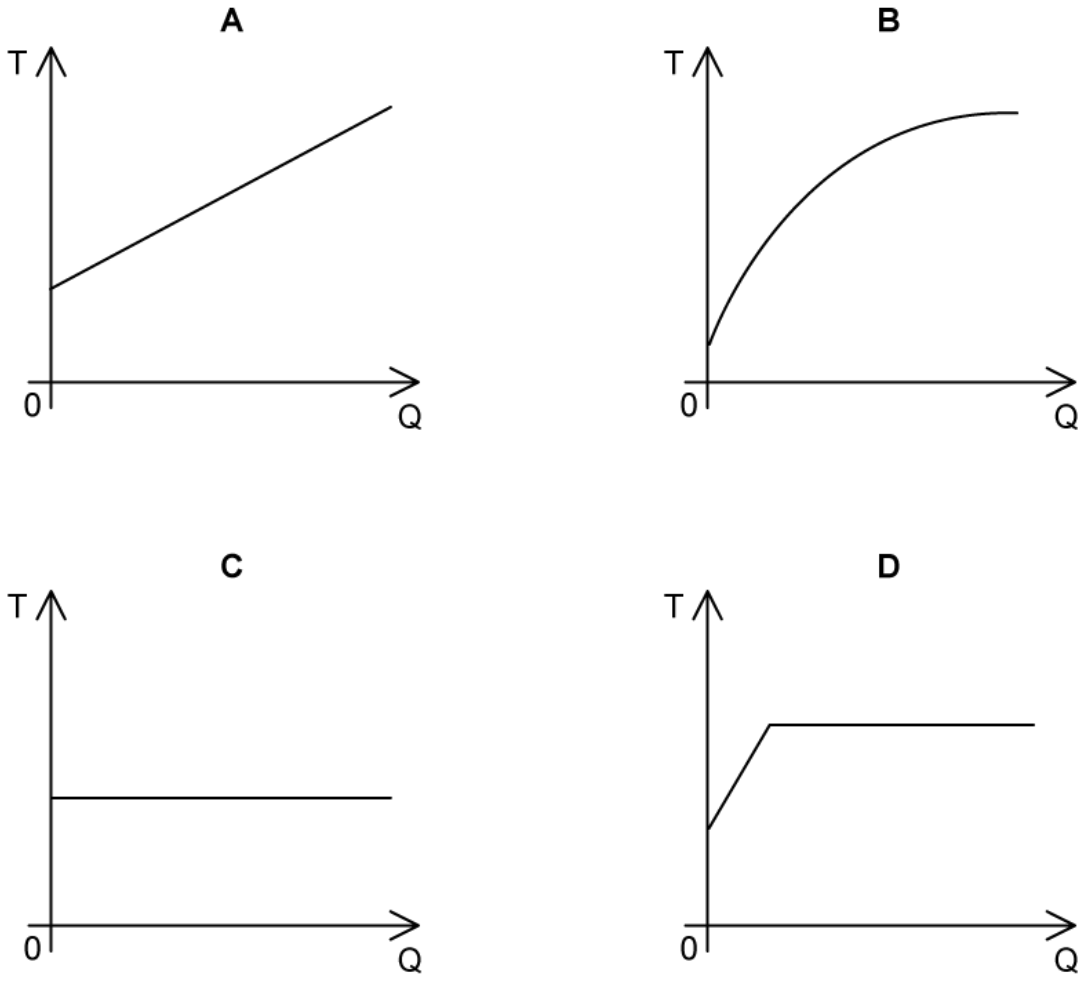

(1 mark)

30 The Sankey diagram shows the energy transformations in a laptop computer while a person is watching a film.

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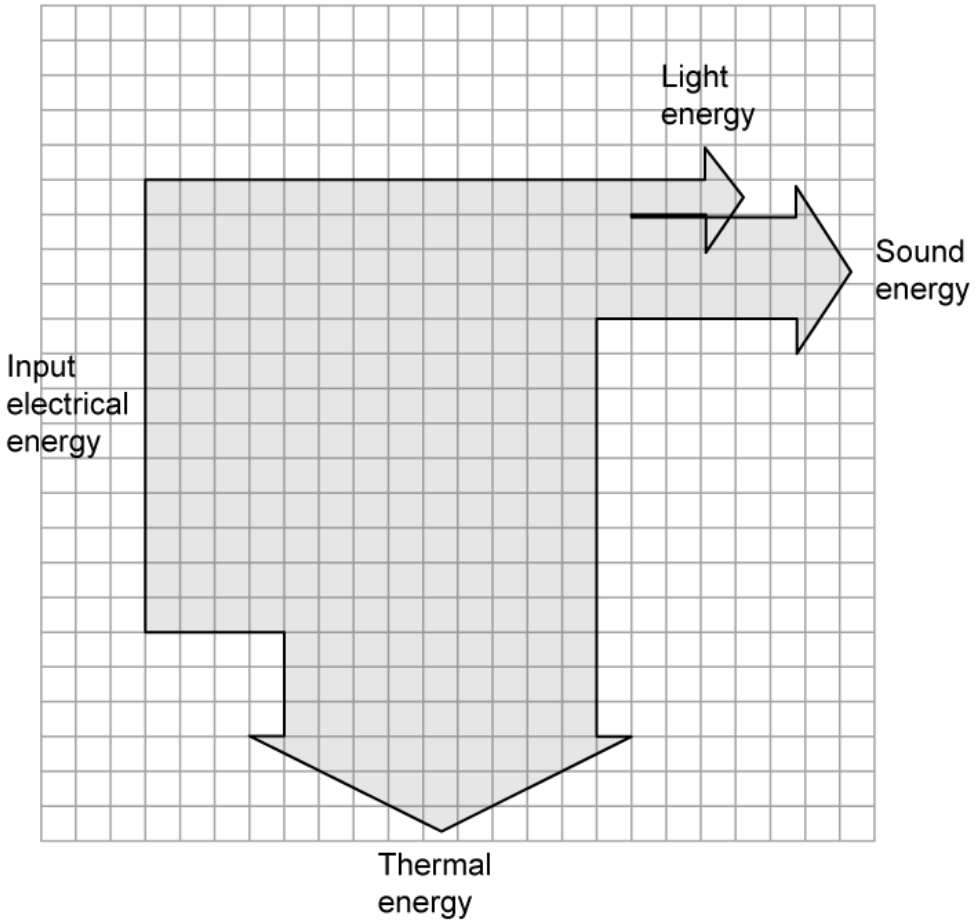

What is the efficiency of the laptop?

A. 3 %

B. 8 %

C. 31 %

D. 69 %

(1 mark)

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