

# The Young Modulus

## TOPIC QUESTIONS

<b>Level</b>	<b>AS Level</b>
<b>Subject</b>	<b>Physics</b>
<b>Exam Board</b>	<b>AQA</b>
<b>Paper Type</b>	<b>Multiple Choice</b>

Time Allowed : 30min

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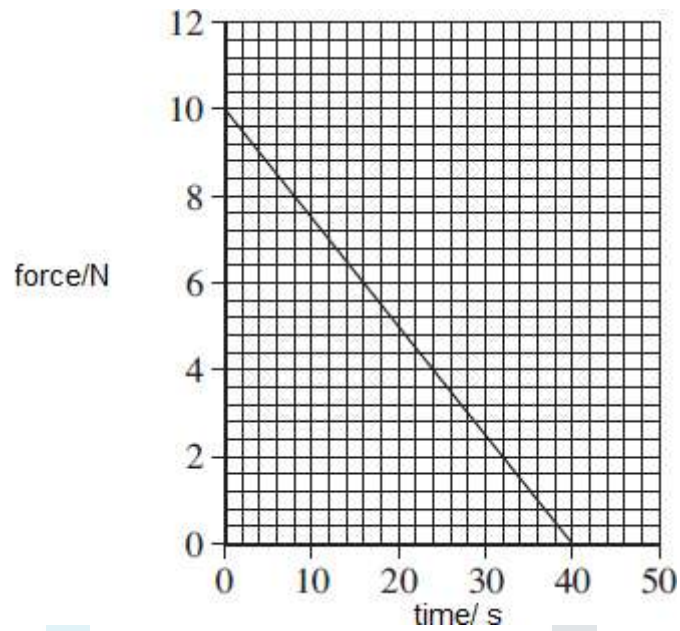
1. Which line, **A** to **D**, in the table correctly describes the trajectory of charged particles which enter separately, at right angles, a uniform electric field, and a uniform magnetic field?

	<b>uniform electric field</b>	<b>uniform magnetic field</b>
<b>A</b>	parabolic	circular
<b>B</b>	circular	parabolic
<b>C</b>	circular	circular
<b>D</b>	parabolic	parabolic



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2. The graph shows how the force acting on a body changes with time.

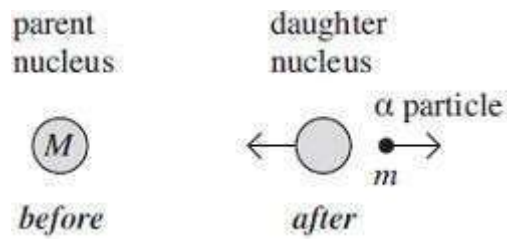


The body has a mass of 0.25 kg and is initially at rest. What is the speed of the body after 40 s assuming no other forces are acting?

- A  $200 \text{ ms}^{-1}$
- B  $400 \text{ ms}^{-1}$
- C  $800 \text{ ms}^{-1}$
- D  $1600 \text{ ms}^{-1}$

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3. A stationary unstable nucleus of mass  $M$  emits an  $\alpha$  particle of mass  $m$  with kinetic energy  $E$ .



What is the speed of recoil of the daughter nucleus?

A  $\frac{\sqrt{2mE}}{(M - m)}$

B  $\frac{\sqrt{2mE}}{M}$

C  $\frac{(M - m)}{\sqrt{2mE}}$

D  $\frac{2mE}{(M - m)^2}$

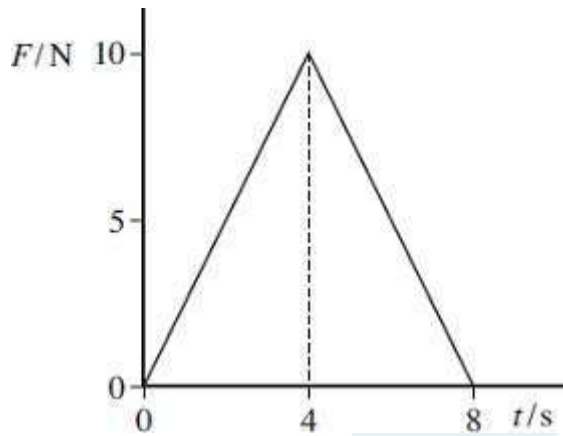


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4. Two ice skaters, initially at rest and in contact, push apart from each other.  
Which line, **A** to **D**, in the table states correctly the change in the total momentum and the total kinetic energy of the two skaters?

	<b>total momentum</b>	<b>total kinetic energy</b>
<b>A</b>	unchanged	increases
<b>B</b>	unchanged	unchanged
<b>C</b>	increases	increases
<b>D</b>	increases	unchanged

5. A ball of mass 2.0 kg, initially at rest, is acted on by a force  $F$  which varies with time  $t$  as shown by the graph.



What is the velocity of the ball after 8.0 s?

- A  $20 \text{ ms}^{-1}$   
B  $40 \text{ ms}^{-1}$   
C  $80 \text{ ms}^{-1}$   
D  $160 \text{ ms}^{-1}$
6. A ballbearing **X** of mass  $2m$  is projected vertically upwards with speed  $u$ . A ballbearing **Y** of mass  $m$

is projected at  $30^\circ$  to the horizontal with speed  $2u$  at the same time. Air resistance is negligible. Which of the following statements is correct?

- A The horizontal component of **Y**'s velocity is  $u$ .  
B The maximum height reached by **Y** is half that reached by **X**.  
C **X** and **Y** reach the ground at the same time.  
D **X** reaches the ground first.

7. What is the relationship between the distance  $y$  travelled by an object falling freely from rest and the time  $x$  the object has been falling?

A  $y$  is proportional to  $x^2$

B  $y$  is proportional to  $\sqrt{x}$

C  $y$  is proportional to  $\frac{1}{x}$

D  $y$  is proportional to  $\frac{1}{x^2}$

8. A car exerts a driving force of 500 N when travelling at a constant speed of  $72 \text{ km h}^{-1}$  on a level track. What is the work done in 5 minutes?

A  $3.0 \times 10^6 \text{ J}$

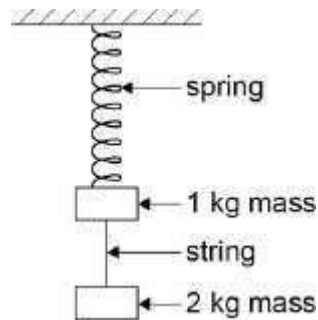
B  $2.0 \times 10^6 \text{ J}$

C  $2.0 \times 10^5 \text{ J}$

D  $1.1 \times 10^5 \text{ J}$

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9. Two masses hang at rest from a spring, as shown in the diagram. The string separating the masses is burned through.



Which of the following gives the accelerations of the two masses as the string breaks? acceleration of free fall =  $g$

	acceleration of 1 kg mass upwards in $\text{m s}^{-2}$	acceleration of 2 kg mass downwards in $\text{m s}^{-2}$
A	$3g$	$1g$
B	$2g$	$2g$
C	$2g$	$1g$
D	$1g$	$1g$

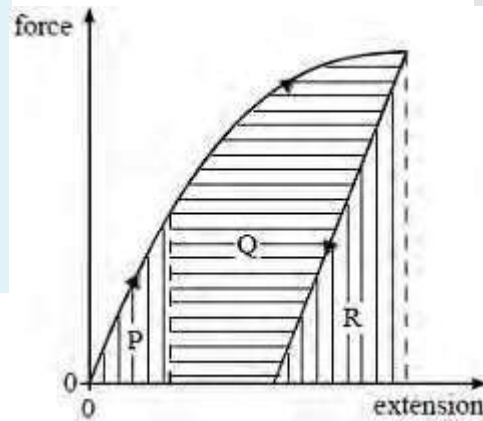
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10. An object falls freely from rest. After falling a distance  $d$  its velocity is  $v$ . What is its velocity after it has fallen a distance  $2d$ ?

- A  $2v$
- B  $4v$
- C  $2v^2$
- D  $\sqrt{2}v$

11. The force on a sample of a material is gradually increased and then decreased. The graph of force against extension is shown in the diagram.



The increase in thermal energy in the sample is represented by area

- A R
- B  $P + Q$
- C  $P + Q + R$
- D  $P + Q - R$

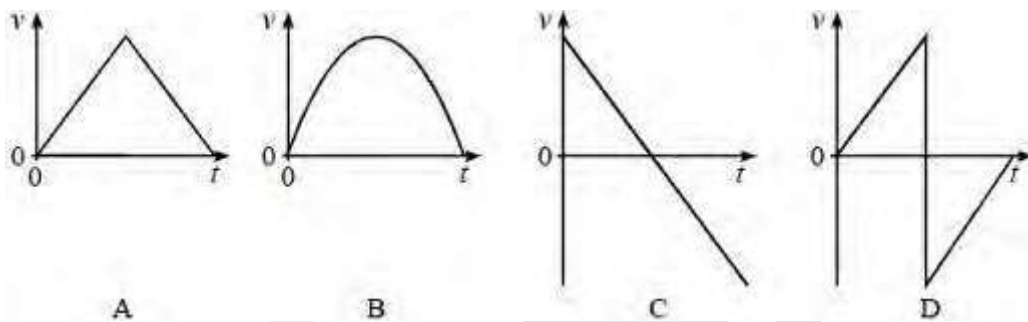
12. The diagram shows a strobe photograph of a mark on a trolley X, moving from right to left, in collision with another trolley Y which had no mark on it. After the collision both trolleys are in motion together.



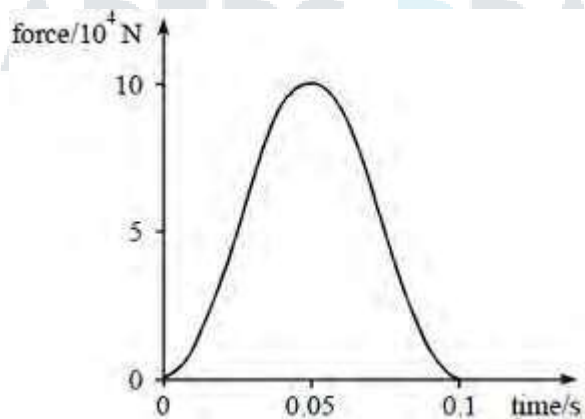
Which **one** of the following is consistent with the photograph?

- A Trolley Y has the same mass as trolley X and was initially stationary
- B Trolley Y had a smaller mass than X and was moving from right to left
- C Trolley Y had the same mass and was initially moving left to right at the same speed as trolley X
- D Trolley Y had the same mass and was initially moving left to right at a higher speed than trolley X

13. A perfectly elastic rubber ball falls vertically from rest and rebounds from the floor. Which one of the following velocity-time,  $v-t$ , graphs best represents the motion from the moment of release to the top of the first rebound?



14. The diagram shows the graph of force on a car against time when the car of mass 500 kg crashes



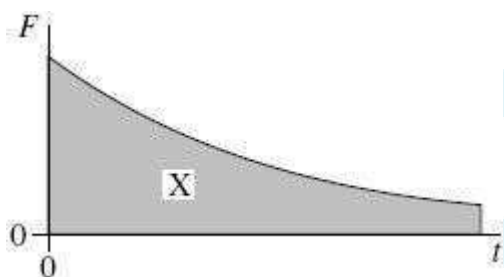
Which one of the following statements is correct?

- A The area under the graph is equal to the initial momentum of the car
  - B Momentum is not conserved in the collision
  - C Kinetic energy is conserved in the collision
  - D The average force exerted on the car is  $10 \times 10^4$  N
15. A stone is projected horizontally by a catapult consisting of two rubber cords. The cords, which obey Hooke's law, are stretched and released. When each cord is extended by  $x$ ,

the stone is projected with a speed  $v$ . Assuming that all the strain energy in the rubber is transferred to the stone, what is the speed of the stone when each cord is extended by  $2x$ ?

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

16. The graph shows the variation with time,  $t$ , of the force,  $F$ , acting on a body.



What physical quantity does the area X represent?

- A the displacement of the body
- B the acceleration of the body
- C the change in momentum of the body
- D the change in kinetic energy of the body

17. Water of density  $1000 \text{ kg m}^{-3}$  flows out of a garden hose of cross-sectional area  $7.2 \times 10^{-4} \text{ m}^2$  at a rate of  $2.0 \times 10^{-4} \text{ m}^3$  per second. How much momentum is carried by the water leaving the hose per second?

- A  $5.6 \times 10^{-5} \text{ N s}$
- B  $5.6 \times 10^{-2} \text{ N s}$
- C  $0.20 \text{ N s}$
- D  $0.72 \text{ N s}$

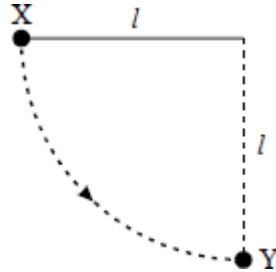
18. Which row, **A** to **D**, in the table correctly shows the quantities conserved in an inelastic collision?

	mass	momentum	kinetic energy	total energy
<b>A</b>	conserved	not conserved	conserved	conserved
<b>B</b>	not conserved	conserved	conserved	not conserved
<b>C</b>	conserved	conserved	conserved	conserved
<b>D</b>	conserved	conserved	not conserved	conserved

19. A 10 mF capacitor is charged to 10 V and then discharged completely through a small motor. During this process, the motor lifts a weight of mass 0.10 kg. If 10% of the energy stored in the capacitor is used to lift the weight, through what approximate height will the weight be lifted?

- A 0.05 m
- B 0.10 m
- C 0.50 m
- D 1.00m

20.



A ball of mass  $m$ , which is fixed to the end of a light string of length  $l$ , is released from rest at X. It swings in a circular path, passing through the lowest point Y at speed  $u$ . If the tension in the string at Y is  $T$ , which one of the following equations represents a correct application of Newton's laws of motion to the ball at Y?

A  $T = \frac{mv^2}{l} - mg$

B  $T - mg = \frac{mv^2}{l}$

C  $mg - T = \frac{mv^2}{l}$

D  $T + \frac{mv^2}{l} = mg$

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