IB PHYSICS

Name: _____

Period: _____ Date: _____

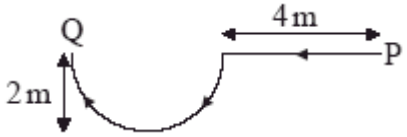
Marks: 69 Raw Score: ____ IB Curve: ____

DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

CHAPTER 2 TEST REVIEW

1. Samantha walks along a horizontal path in the direction shown. The curved part of the path is a semi-circle.



The magnitude of her displacement from point P to point Q is approximately

A. 2 m.

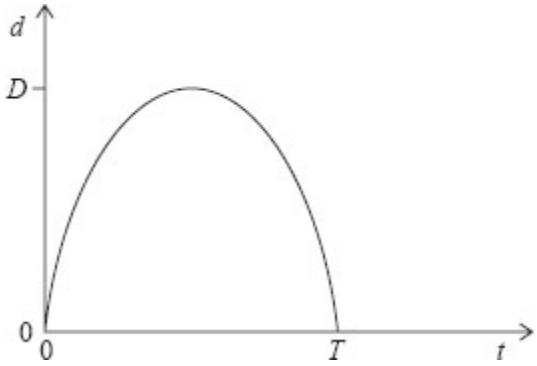
B. 4 m.

C. 6 m.

D. 8 m.

(Total 1 mark)

2. A ball is thrown vertically upwards from the ground. The graph shows the variation with time *t* of the vertical displacement *d* of the ball.



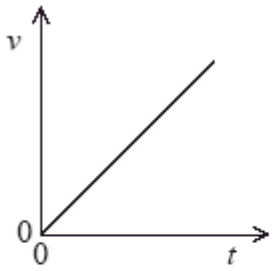
Which of the following gives the final displacement after time *T* and the average speed between time $t = 0$ and time $t = T$?

	Displacement	Average speed
A.	0	0
B.	0	$\frac{2D}{T}$
C.	$2D$	$\frac{2D}{T}$
D.	$2D$	0

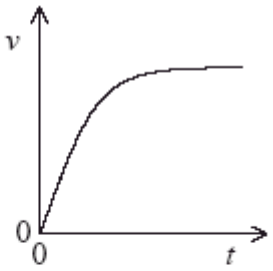
(Total 1 mark)

3. A raindrop falling from rest at time $t = 0$ reaches terminal velocity. Which graph best represents how the speed v varies with time t?

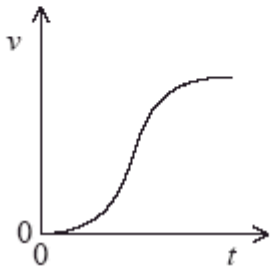
A.



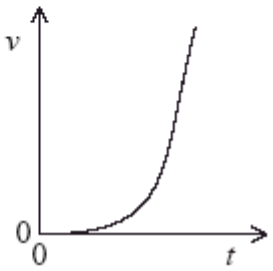
B.



C.



D.



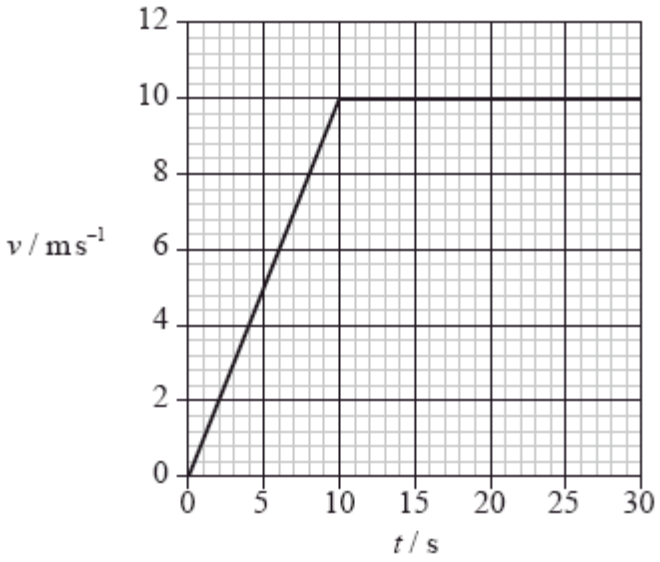
(Total 1 mark)

4. Which of the following quantities can be determined from a speed-time graph of a particle travelling in a straight line?

A. Only the magnitude of the acceleration at a given instant
B. Both the velocity and the acceleration at a given instant
C. Only the distance travelled in a given time
D. Both the distance travelled in a given time and the magnitude of the acceleration at a given instant

(Total 1 mark)

5. Joseph runs along a long straight track. The variation of his speed v with time t is shown below.



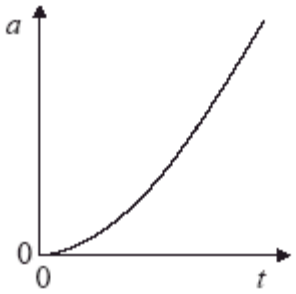
After 25 seconds Joseph has run 200 m. Which of the following is correct at 25 seconds?

	Instantaneous speed / m s^{-1}	Average speed / m s^{-1}
A.	8 m s^{-1}	8 m s^{-1}
B.	8 m s^{-1}	10 m s^{-1}
C.	10 m s^{-1}	8 m s^{-1}
D.	10 m s^{-1}	10 m s^{-1}

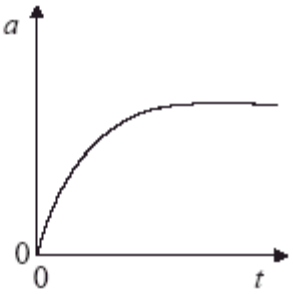
(Total 1 mark)

6. A ball, initially at rest, is dropped in the air from a great height. Air resistance is not negligible. Which of the following graphs best shows the variation with time t of the acceleration a of the ball?

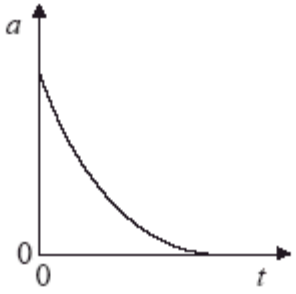
A.



B.



C.



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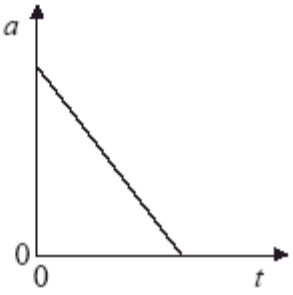


(Total 1 mark)

7. A skydiver jumped out of an airplane. On reaching a terminal speed of 60 m s^{-1}, she opened her parachute. Which of the following describes her motion after opening her parachute?

A. She went upwards for a short time, before falling to Earth at a speed of 60 m s^{-1}.

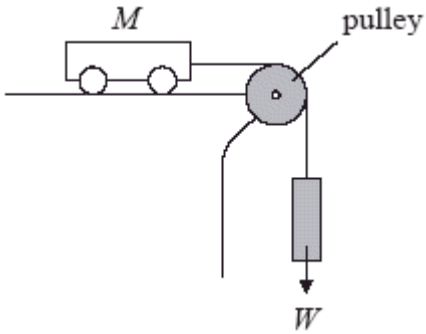
B. She continued downwards at 60 m s^{-1}, but hit the ground with less force.

C. She continued to fall but reached a new terminal speed of less than 60 m s^{-1}.

D. She went upwards for a short time, before falling to Earth at a speed of less than 60 m s^{-1}.

(Total 1 mark)

8. A cart of mass M is on a horizontal frictionless table.



The cart is connected to an object of weight W via a pulley.

Which of the following is the acceleration of the cart?

A. $\dfrac{M+\dfrac{W}{g}}{W}$

B. $\dfrac{W}{M+\dfrac{W}{g}}$

C. $\dfrac{Mg}{W}$

D. 0

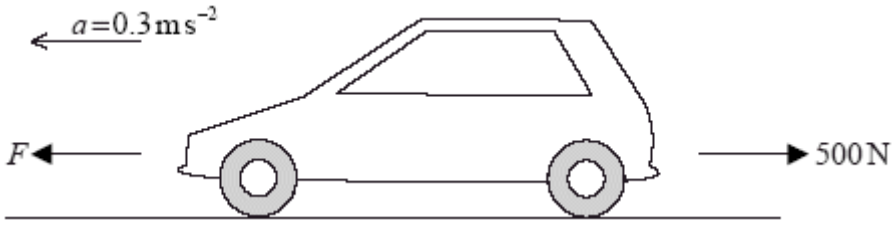
(Total 1 mark)

9. Objects *A* and *B* collide together. They end up joined together and stationary. During the collision, a force $+F$ is exerted on object *A* by object *B*. According to Newton's third law, there will also be a force of

A. $-F$ acting on object *B*.
B. $-F$ acting on object *A*.
C. $+F$ acting on object *B*.
D. $+F$ acting on object *A*.

(Total 1 mark)

10. A car of mass 1000 kg accelerates on a straight, flat, horizontal road with an acceleration $a = 0.3\ \text{m s}^{-2}$.
The driving force *F* on the car is opposed by a resistive force of 500 N.



The net (resultant) force on the car is

A. 200 N.
B. 300 N.
C. 500 N.
D. 800 N.

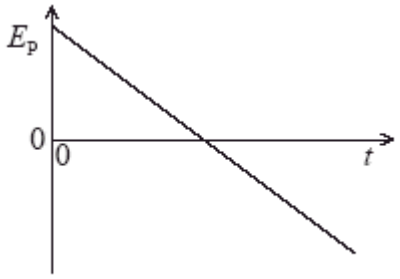
(Total 1 mark)

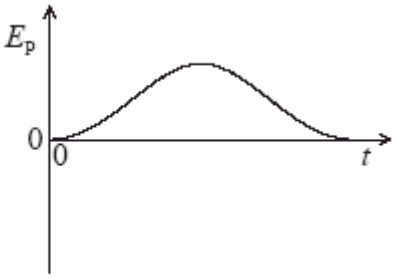
11. A wooden block is sliding down an inclined plane at constant speed. The magnitude of the frictional force between the block and the plane is equal to

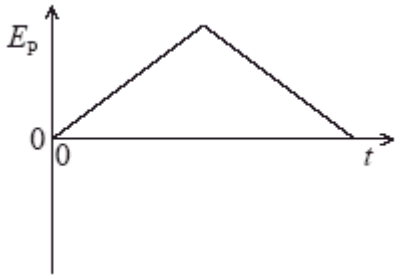
A. zero.
B. the magnitude of the weight of the block.
C. the magnitude of the component of weight of the block parallel to the plane.
D. the magnitude of the component of the normal reaction parallel to the plane.

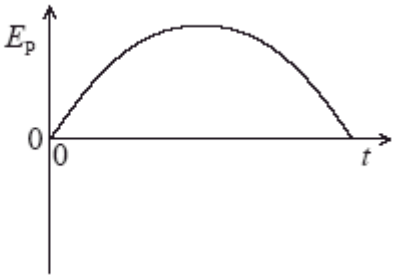
(Total 1 mark)

12. A ball is thrown vertically upwards and comes down again. Air resistance is negligible. Which of the following graphs shows how the gravitational potential energy E_P varies with time *t*?

A.


B.


C.


D.


(Total 1 mark)

13. Which of the following is a correct definition of work?

A. Product of force and distance

B. Product of force and distance moved in the direction of the force

C. Product of power and time

D. Product of force and displacement

(Total 1 mark)

14. A nuclear power station produces 10 GW of electrical power. The power generated by the nuclear reactions in the core of the reactor is 25 GW. The efficiency of the power station is

A. 15 %.

B. 35 %.

C. 40 %.

D. 60 %.

(Total 1 mark)

15. A pump extracts water from a well of depth h at a constant rate of R kg s^{-1}. What is the power required to raise the water?

A. $\frac{R}{gh}$

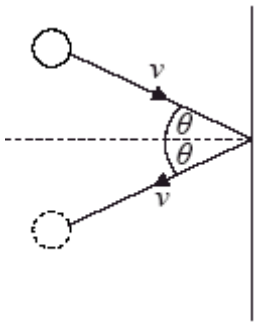
B. Rgh

C. $\frac{Rg}{h}$

D. $\frac{hg}{R}$

(Total 1 mark)

16. A gas atom strikes a wall with speed v at an angle θ to the normal to the wall. The atom rebounds at the same speed v and angle θ.



Which of the following gives the magnitude of the momentum change of the gas atom?

A. zero

B. $2mv \sin\theta$

C. $2mv$

D. $2mv \cos\theta$

(Total 1 mark)

17. A constant force of magnitude F is applied to a mass m for a time interval Δt. The magnitude of the impulse given to the mass equals

A. $\frac{F}{m}$.

B. $\frac{F}{\Delta t}$.

C. $F\Delta t$.

D. $\frac{F\Delta t}{m}$.

(Total 1 mark)

18. A general expression for Newton's second law of motion is

$$F = \frac{\Delta p}{\Delta t}.$$

What condition is applied so that the law may be expressed in the form $F = ma$?

A. The mass m is constant.

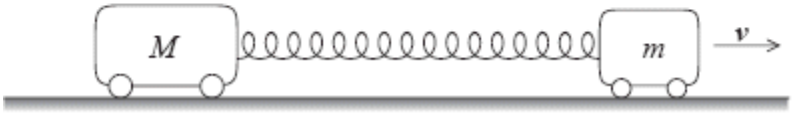
B. The acceleration a is constant.

C. The force F is constant.

D. The direction of the force F is constant.

(Total 1 mark)

19. Two carts of different mass m and M are connected by a spring. They are pushed together such that the spring is compressed.



After the carts are released, the cart of mass m moves with velocity $\boldsymbol{v}$. The change in the momentum of mass M is

A. $m\boldsymbol{v}$.

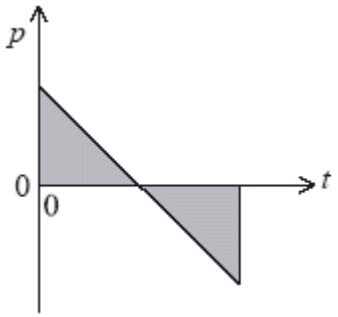
B. $-m\boldsymbol{v}$.

C. $M\boldsymbol{v}$.

D. $-M\boldsymbol{v}$.

(Total 1 mark)

20. A rubber ball, travelling in a horizontal direction, strikes a vertical wall. It rebounds at right angles to the wall. The graph below illustrates the variation of the ball's momentum p with time t when the ball is in contact with the wall.



Which of the following statements is true?

A. The shaded area is equal to the force exerted by the wall on the ball.

B. The shaded area is equal to the force exerted by the ball on the wall.

C. The gradient is equal to the force exerted by the wall on the ball.

D. The gradient is equal to the force exerted by the ball on the wall.

(Total 1 mark)

21. In 1997 a high-speed car of mass 1.1×10^4 kg achieved the world land speed record. The car accelerated uniformly in two stages as shown in the table. The car started from rest.

	Time / s	**Speed attained at end of stage / m s^{-1}**
Stage 1	0.0 – 4.0	44
Stage 2	4.0 – 12	280

Use the data to calculate the

(a) average acceleration of the car in stage 1.

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(1)

(b) average net force required to accelerate the car in stage 2.

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(3)

(c) total distance travelled by the car in 12 s.

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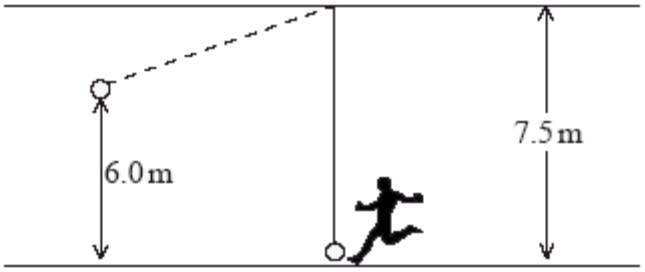
(2)

22. This question is about kicking a football.

A ball is suspended from a ceiling by a string of length 7.5 m. The ball is kicked horizontally and rises to a maximum height of 6.0 m.



(a) Assuming that the air resistance is negligible, show that the initial speed of the ball is 11 m s^{-1}.

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(2)

(b) The mass of the ball is 0.55 kg and the impact time of the kicker's foot with the ball is 150 ms. Estimate the average force exerted on the ball by the kick.

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(2)

(c) (i) Explain why the tension in the string increases immediately after the ball is kicked.

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(3)

(ii) Calculate the tension in the string immediately after the ball is kicked. Assume that the string is vertical.

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(3)

23. Mechanical power

(a) Define *power*.

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(1)

(b) A car is travelling with constant speed v along a horizontal straight road. There is a total resistive force F acting on the car.

Deduce that the power P to overcome the force F is $P = Fv$.

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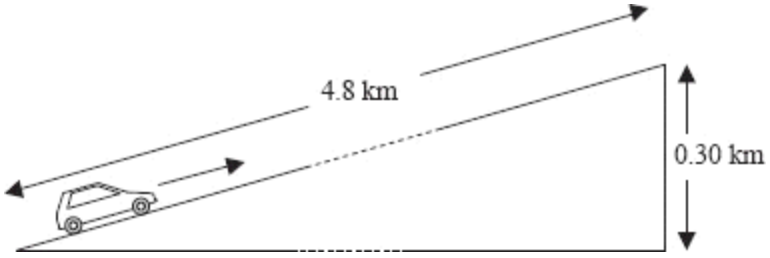
(2)

(c) A car drives up a straight incline that is 4.8 km long. The total height of the incline is 0.30 km.



The car moves up the incline at a steady speed of 16 m s^{-1}. During the climb, the average friction force acting on the car is 5.0×10^2 N. The total weight of the car and the driver is 1.2×10^4 N.

(i) Determine the time it takes the car to travel from the bottom to the top of the incline.

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(2)

(ii) Determine the work done against the gravitational force in travelling from the bottom to the top of the incline.

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(1)

(iii) Using your answers to (c)(i) and (c)(ii), calculate a value for the minimum power output of the car engine needed to move the car from the bottom to the top of the incline.

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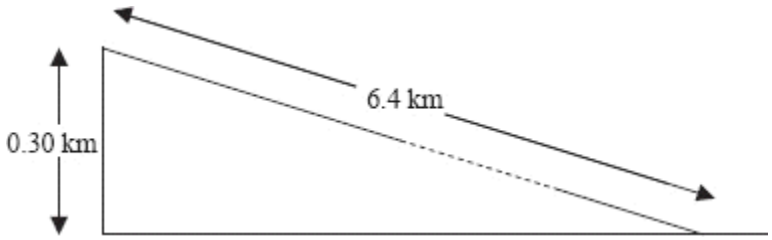
(4)

(d) From the top of the incline, the road continues downwards in a straight line. At the point where the road starts to go downwards, the driver of the car in (c), stops the car to look at the view. In continuing his journey, the driver decides to save fuel. He switches off the engine and allows the car to move freely down the hill. The car descends a height of 0.30 km in a distance of 6.4 km before levelling out.



The average resistive force acting on the car is 5.0×10^2 N.

Estimate

(i) the acceleration of the car down the incline.

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(5)

(ii) the speed of the car at the bottom of the incline.

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(2)

(e) In fact, for the last few hundred metres of its journey down the hill, the car travels at constant speed. State the value of the frictional force acting on the car whilst it is moving at constant speed.

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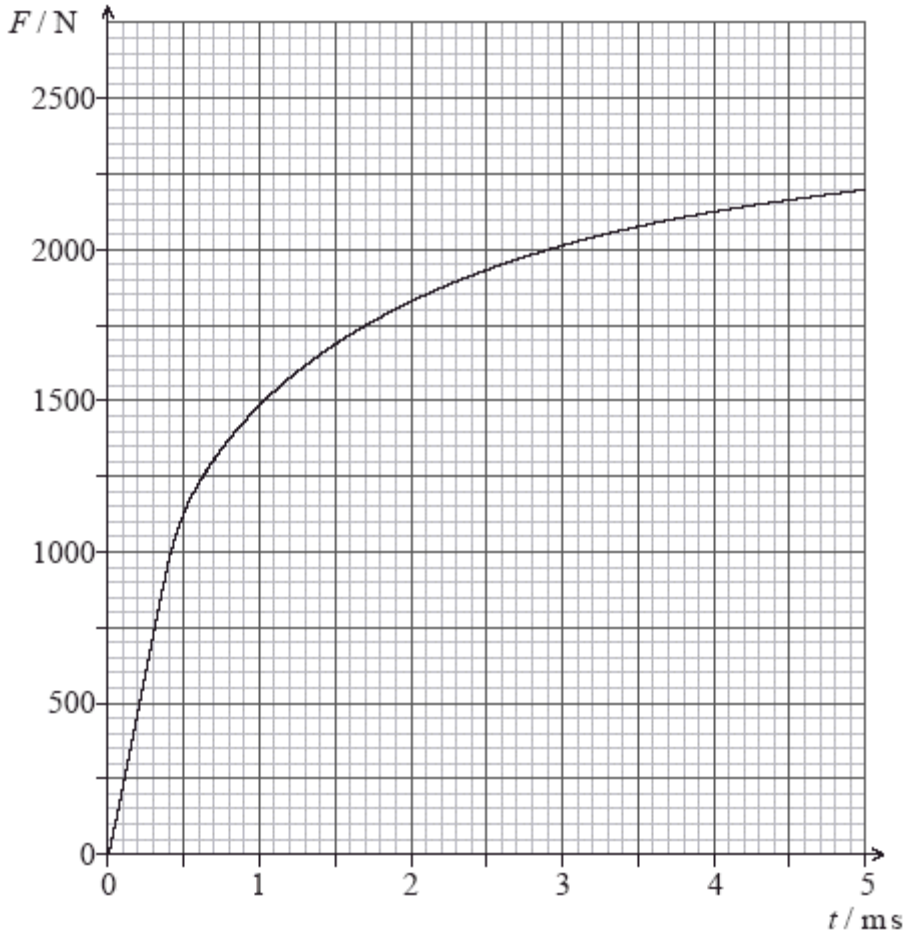
(1)

24. This question is about dynamics and energy.

A bullet of mass 32 g is fired from a gun. The graph shows the variation of the force F on the bullet with time t as it travels along the barrel of the gun.



The bullet is fired at time $t = 0$ and the length of the barrel is 0.70 m.

(a) State and explain why it is inappropriate to use the equation $s = ut + \frac{1}{2}at^2$ to calculate the acceleration of the bullet.

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(2)

(b) Use the graph to

(i) determine the average acceleration of the bullet during the final 2.0 ms of the graph.

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(2)

(ii) show that the change in momentum of the bullet, as the bullet travels along the length of the barrel, is approximately 9 N s.

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(3)

(c) Use the answer in (b)(ii) to calculate the

(i) speed of the bullet as it leaves the barrel.

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(2)

(ii) average power delivered to the bullet.

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(3)

(d) Use Newton's third law to explain why a gun will recoil when a bullet is fired.

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(3)