

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. How much work is required to lift a 2-kilogram mass to a height of 10 meters?

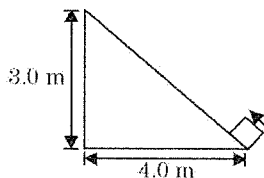
- A. 5 joules
- B. 20 joules
- C. 100 joules
- D. 200 joules

2. How much work is done on a 300-newton suitcase to lift it 0.50 meter?

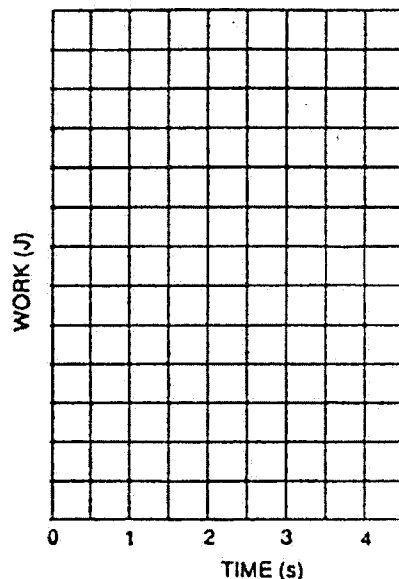
- A. 600 joules
- B. 300 joules
- C. 150 joules
- D. 75 joules

3. A 20-newton block is at rest at the bottom of a frictionless incline as shown in the diagram. How much work must be done against gravity to move the block to the top of the incline?

- A. 10 J
- B. 60 J
- C. 80 J
- D. 100 J



4.



A student performs a laboratory activity in which a 15-newton force acts on a 2.0-kilogram mass. The work done over time is summarized in the table shown.

DATA TABLE

Time (s)	Work (J)
0	0
1.0	32
2.0	59
3.0	89
4.0	120

- a) Using the information in the data table, construct a graph on a grid, following the directions given.
  - 1) Develop an appropriate scale for work and plot the points for a *work-versus-time* graph.
  - 2) Draw the best-fit line.
- b) Calculate the value of the slope of the graph constructed in the previous part. (Show all calculations, including equations and substitutions with units.)
- c) Based on your graph, how much time did it take to do 75 joules of work?

5. Which quantity and unit are correctly paired?

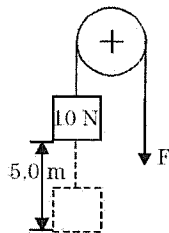
- A. velocity:  $\text{m/s}^2$
- B. momentum:  $\frac{\text{kg} \cdot \text{m}}{\text{s}^2}$
- C. energy:  $\frac{\text{kg} \cdot \text{m}^2}{\text{s}^2}$
- D. work:  $\text{kg/m}$

6. A jack exerts a force of 4,500 newtons to raise a car 0.25 meter. What is the approximate work done by the jack?

- A.  $5.6 \times 10^{-5} \text{ J}$
- B.  $1.1 \times 10^3 \text{ J}$
- C.  $4.5 \times 10^3 \text{ J}$
- D.  $1.8 \times 10^4 \text{ J}$

7. In the diagram, 55 joules of work is needed to raise a 10-newton weight 5.0 meters at a constant speed. How much work is done to overcome friction as the weight is raised?

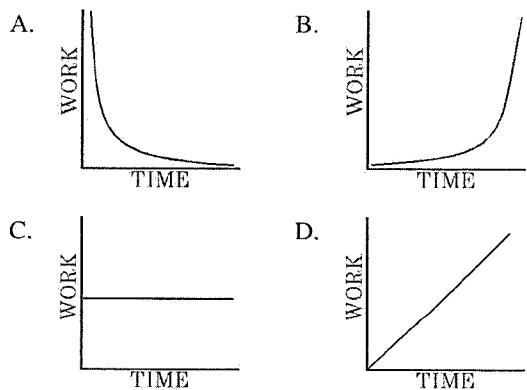
- A. 5 J
- B. 5.5 J
- C. 11 J
- D. 50 J



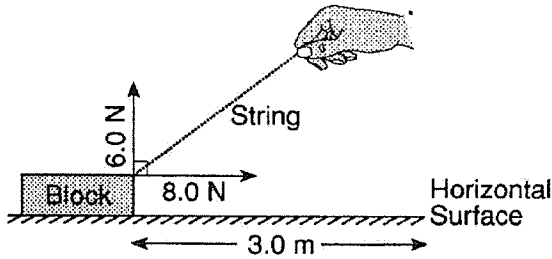
8. A net force of 5.0 newtons moves a 2.0-kilogram object a distance of 3.0 meters in 3.0 seconds. How much work is done on the object?

- A. 1.0 J
- B. 10 J
- C. 15 J
- D. 30 J

9. A student running up a flight of stairs increases her speed at a constant rate. Which graph best represents the relationship between work and time for the student's run up the stairs?

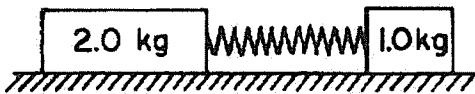


10. A student pulls a block 3.0 meters along a horizontal surface at constant velocity. The diagram shows the components of the force exerted on the block by the student. How much work is done against friction?



- A. 18J    B. 24J    C. 30J    D. 42J

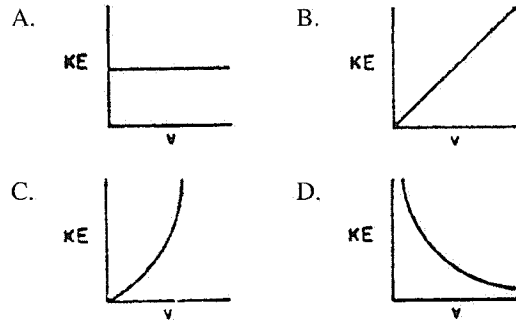
11. The diagram shown represents two objects at rest on a frictionless horizontal surface with a spring compressed between them. When the compressed spring is released, the two objects are pushed apart.



What kinetic energy does the 2.0-kilogram object have after gaining a velocity of 5.0 meters per second?

- A. 25J    B. 20J    C. 10J    D. 5.0J

12. Which graph best represents the relationship between the kinetic energy (KE) of a moving object as a function of its velocity ( $v$ )?



13. A student rides a bicycle up a  $30^\circ$  hill at a constant speed of 6.00 meters per second. The combined mass of the student and bicycle is 70.0 kilograms. What is the kinetic energy of the student-bicycle system during this ride?

- A. 210J    B. 420J  
C. 1,260J    D. 2,520J

14. An object with a speed of 20 meters per second has a kinetic energy of 400 joules. The mass of the object is

- A. 1.0 kg    B. 2.0 kg  
C. 0.50 kg    D. 40 kg

15. A  $1.0 \times 10^3$ -kilogram car is moving at a constant speed of 4.0 meters per second. What is the kinetic energy of the car?

- A.  $1.6 \times 10^3$  J      B.  $2.0 \times 10^4$  J  
C.  $8.0 \times 10^3$  J      D.  $4.0 \times 10^3$  J

16. Car A and car B of equal mass travel up a hill. Car A moves up the hill at a constant speed that is twice the constant speed of car B. Compared to the power developed by car B, the power developed by car A is

- A. the same      B. twice as much  
C. half as much      D. four times as much

17. Car A and car B are of equal mass and travel up a hill. Car A moves up the hill at a constant speed that is twice the constant speed of car B. Compared to the power developed by car B, the power developed by car A is

- A. the same      B. twice as much  
C. half as much      D. four times as much

18. Which term is a unit of power?

- A. joule      B. newton  
C. watt      D. hertz

19. A motor has an output of 1,000 watts. When the motor is working at full capacity, how much time will it require to lift a 50-newton weight 100 meters?

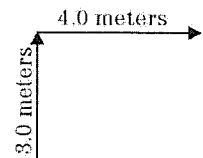
- A. 5 s      B. 10 s      C. 50 s      D. 100 s

20. As the time required to do a given quantity of work decreases, the power developed

- A. decreases      B. increases  
C. remains the same

21. What is the magnitude of the resultant of a 3.0-meter displacement and a 4.0-meter displacement as shown in the diagram?

- A. 1.0 meter  
B. 5.0 meters  
C. 7.0 meters  
D. 12 meters



22. A person walks 5.0 kilometers north, then 5.0 kilometers east. His displacement is closest to
- A. 7.1 kilometers northeast
  - B. 7.1 kilometers northwest
  - C. 10 kilometers northeast
  - D. 10 kilometers northwest

23. Distance is to displacement as
- A. force is to weight
  - B. speed is to velocity
  - C. velocity is to acceleration
  - D. impulse is to momentum

24. A person travels 6 meters north, 4 meters east, and 6 meters south. What is the total displacement?
- A. 16 m east
  - B. 6 m north
  - C. 6 m south
  - D. 4 m east

25. A car travels 20 meters east in 1.0 second. The displacement of the car at the end of this 1.0-second interval is

- A. 20 m
- B. 20 m/s
- C. 20 m east
- D. 20 m/s east





26. A car travels 300 meters in 15 seconds. What is the average velocity of the car?

- A. 5.0 m/sec
- B. 15 m/sec
- C. 20 m/sec
- D. 30 m/sec





27. How long will it take an object to move 100 meters if the object is traveling with an average speed of 0.5 meter per second?

- A. 200 sec
- B. 2 sec
- C. 5 sec
- D. 50 sec

28. A blinking light of constant period is situated on a lab cart. Which diagram best represents a photograph of the light as the cart moves with constant velocity?

- A. 
- B. 
- C. 
- D. 

29. A blinking light of constant period is situated on a lab cart. Which diagram best represents a photograph of the light as the cart moves with constant velocity?

- A. 
- B. 
- C. 
- D. 

30. What is the distance traveled by an object that moves with an average speed of 6.0 meters per second for 8.0 seconds?

- A. 0.75 m                      B. 1.3 m
- C. 14 m                         D. 48 m

31. The diagram represents a block sliding along a frictionless surface between points A and G.



Which formula represents the velocity of the block as it moves along the horizontal surface from point E to point F?

- A.  $v = \frac{\Delta s}{\Delta t}$                       B.  $v = \frac{\Delta v}{2}$
- C.  $v_f^2 = 2a\Delta s$                       D.  $\Delta v = \frac{1}{2}a(\Delta t)^2$

32. A runner completed the 100-meter dash in 10.0 seconds. Her average speed was

- A. 0.100 m/s                      B. 10.0 m/s
- C. 100 m/s                         D. 1,000 m/s

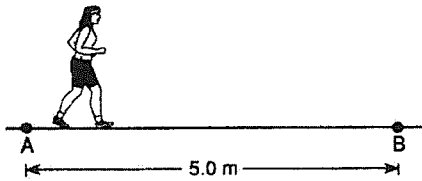
33. A group of bike riders took a 4.0 hour trip. During the first 3.0 hours, they traveled a total of 50 kilometers, but during the last hour they traveled only 10 kilometers. What was the group's average speed for the entire trip?

- A. 15 km/hr                         B. 30 km/hr
- C. 40 km/hr                         D. 60 km/hr

34. A car travels a distance of 98 meters in 10 seconds. What is the average speed of the car during this 10-second interval?

- A. 4.9 m/s
- B. 9.8 m/s
- C. 49 m/s
- D. 98 m/s

35. A jogger accelerates at a constant rate as she travels 5.0 meters along a straight track from point A to point B, as shown in the diagram. If her speed was 2.0 meters per second at point A and will be 3.0 meters per second at point B, how long will it take her to go from A to B?



- A. 1.0 s
- B. 2.0 s
- C. 3.3 s
- D. 4.2 s

36. A car accelerates uniformly from rest to a speed of 10 meters per second in 2 seconds. The acceleration of the car is

- A.  $0.2 \text{ m/sec}^2$
- B.  $5 \text{ m/sec}^2$
- C.  $10 \text{ m/sec}^2$
- D.  $20 \text{ m/sec}^2$

37. A car, starting from rest, accelerates at  $4.0 \text{ m/sec}^2$ . What is its velocity at the end of 8.0 seconds?

- A. 0.50 m/sec
- B. 2.0 m/sec
- C. 16 m/sec
- D. 32 m/sec

38. An object starting from rest accelerates at a rate of 3.0 meters/seconds squared for 6.0 seconds. The velocity of the object at the end of this time is

- A. 0.50 m/s
- B. 2.0 m/s
- C. 3.0 m/s
- D. 18 m/s

39. If an object's velocity changes from 25 meters per second to 15 meters per second in 2.0 seconds, the magnitude of the object's acceleration is

- A.  $5.0 \text{ m/s}^2$
- B.  $7.5 \text{ m/s}^2$
- C.  $13 \text{ m/s}^2$
- D.  $20 \text{ m/s}^2$

40. An object falls freely from rest for three seconds. The *acceleration* of the object is

- A. 10 m/sec
- B.  $10 \text{ m/sec}^2$
- C. 30 m/sec
- D.  $30 \text{ m/sec}^2$

41. A freely falling object near the Earth's surface has a constant
- A. velocity of 1.00 m/s
  - B. velocity of 9.81 m/s
  - C. acceleration of 1.00 m/s<sup>2</sup>
  - D. acceleration of 9.81 m/s<sup>2</sup>

42. An object falls freely from rest near the surface of the Earth. What is the speed of the object when it has fallen 4.9 meters from its rest position?
- A. 4.9 m/s
  - B. 9.8 m/s
  - C. 24 m/s
  - D. 96 m/s

43. An object, starting from rest, accelerates at a rate of 3.0 meters per second<sup>2</sup> for 6.0 seconds. The velocity of the object at the end of this time is
- A. 0.50 m/s
  - B. 2.0 m/s
  - C. 3.0 m/s
  - D. 18 m/s

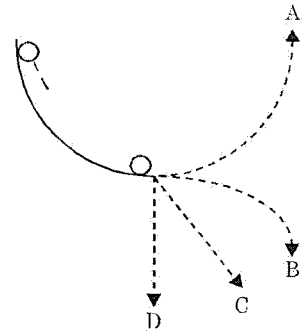
44. Approximately how far will an object near Earth's surface fall in 3.0 seconds?
- A. 88 m
  - B. 44 m
  - C. 29 m
  - D. 9.8 m

45. A steel ball is dropped from a height of 100 meters. The velocity of the ball after one second is 10 meters per second. What is the velocity of the ball after 2 seconds?

- A. 10 m/sec
- B. 20 m/sec
- C. 40 m/sec
- D. 400 m/sec

46. A ball rolls down a curved ramp as shown in the diagram. Which dotted line best represents the path of the ball after leaving the ramp?

- A. A
- B. B
- C. C
- D. D



47. An object is thrown horizontally off a cliff with an initial velocity of 5.0 meters per second. The object strikes the ground 3.0 seconds later. How far from the base of the cliff will the object strike the ground? [Neglect friction.]

- A. 2.9 m
- B. 9.8 m
- C. 15 m
- D. 44 m



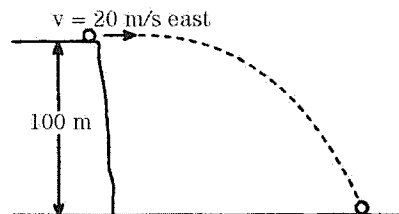
48. A ball is thrown horizontally at a speed of 20 meters per second from the top of a cliff. How long does the ball take to fall 19.6 meters to the ground?

- A. 1.0s    B. 2.0s    C. 9.8s    D. 4.0s

49. A book is pushed with an initial horizontal velocity of 5.0 meters per second off the top of a desk. What is the initial vertical velocity of the book?

- A. 0 m/s                      B. 2.5 m/s  
C. 5.0 m/s                    D. 10 m/s

50. The diagram here shows a ball projected horizontally with an initial velocity of 20 meters per second east, off a cliff 100 meters high. [Neglect air resistance.]



How many seconds does the ball take to reach the ground?

- A. 4.5s    B. 20s    C. 9.8s    D. 2.0s