

苏州十中国际部2023-2024(上)期末考试

The Final-Term Exam for the 1st Semester 2023-2024

Subject: Physics
Grade: 11
Time: 90 minutes
Full Score: 100 points

Name _____

Score _____

Section A

Every question in this Section is worth 4 marks, and there will be only 1 correct option to each. Write down your answers in parentheses.

1.(____) All quantities may be expressed in terms of SI base units.

Which of the following is the SI base unit of force?

- A. N
- B. $kg \cdot m^2 \cdot s$
- C. $kg \cdot m \cdot s^2$
- D. $kg \cdot m \cdot s^{-2}$

2.(____) The gradient of a $v - t$ (velocity-time) graph represents:

- A. average speed
- B. instantaneous speed
- C. average acceleration
- D. instantaneous acceleration

3.(____) Quantities can be scalar or vector. Select the row of the table that correctly states a scalar quantity and a vector quantity.

	Vector	Scalar
A.	acceleration	mass
B.	mass	velocity

	Vector	Scalar
C.	speed	distance
D.	velocity	weight

4.(____) A ball is thrown vertically upwards at a speed of 9.81 m/s .

What is the maximum height it reaches rounded to the nearest tenth?

- A. 9.8m
- B. 4.9m
- C. 19.6m
- D. None of the above

5.(____) A house brick is 23 cm long, 10 cm wide and 7 cm high. It has a mass of 3.38 kg.

What is the brick's density rounded to the nearest integer?

- A. 2100 kg/m^3
- B. 2100 g/m^3
- C. 1379 kg/m^3
- D. 4820 g/cm^3

6.(____) A baseball has a mass of 145 gram, and this baseball travels at 40 m/s.

What is the momentum of the ball?

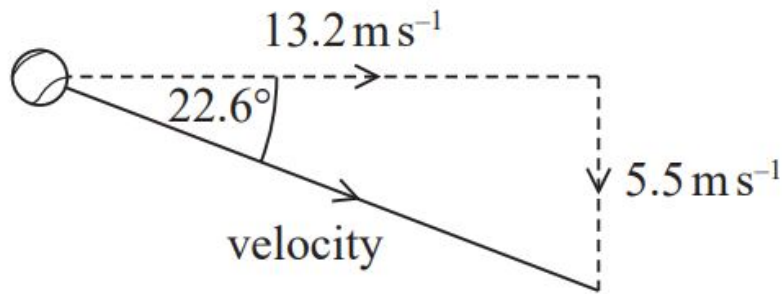
- A. $5.8\text{ kg} \cdot \text{m/s}$
- B. $4.1\text{ kg} \cdot \text{m/s}$
- C. $1.8\text{ kg} \cdot \text{m/s}$
- D. $410\text{ kg} \cdot \text{m/s}$

7.(____) A massive star exerts a gravitational force F_s on a small distant planet. The planet exerts a gravitational force F_p on the star.

Which row of the table is correct?

Magnitude of forces	Direction of forces
$F_p < F_s$	opposite
$F_p < F_s$	the same
$F_p = F_s$	opposite
$F_p = F_s$	the same

8.(____) A tennis ball is moving through the air. The diagram shows the horizontal and vertical components of its velocity.



Which of the following expressions gives the magnitude of the velocity in m/s ?

- A. $13.2 \times \sin(22.6^\circ)$
- B. $5.5 \times \sin(22.6^\circ)$
- C. $\frac{13.2}{\sin(22.6^\circ)}$
- D. $\frac{5.5}{\sin(22.6^\circ)}$

9.(____) A student measured the terminal velocity of different objects as they fell through a liquid. The student used the measurements and Stokes' Law to calculate the viscosity of the liquid.

For which of the following conditions does Stokes' Law apply?

- A. spherical objects and laminar flow
- B. spherical objects and low viscosity
- C. cylindrical objects and laminar flow
- D. cylindrical objects and low viscosity

10.(____) How does momentum, p , relate to kinetic energy, E_k ?

- A. $p^2 = 2E_k$
- B. $2p^2 = E_k$
- C. $p^2 = 2m \cdot E_k$
- D. $2m \cdot p^2 = E_k$

Section B

Please give logical explanation and write down the formula you use to each answer in English.

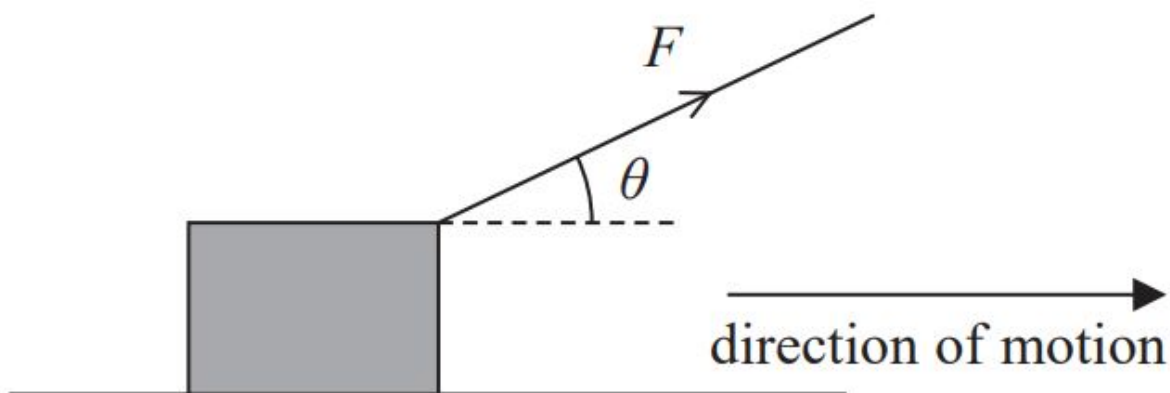
Please note that misspellings of physics terms are not tolerated. 物理术语拼写错误将按0分计答。

11.(total=10 marks) A ball is projected from ground at an angle of 30 degrees. It's initial speed is 2 m/s, ignoring friction, and assume that gravity $g=10 \text{ m/s}^2$

You may draw a diagram depicting the scenario above.

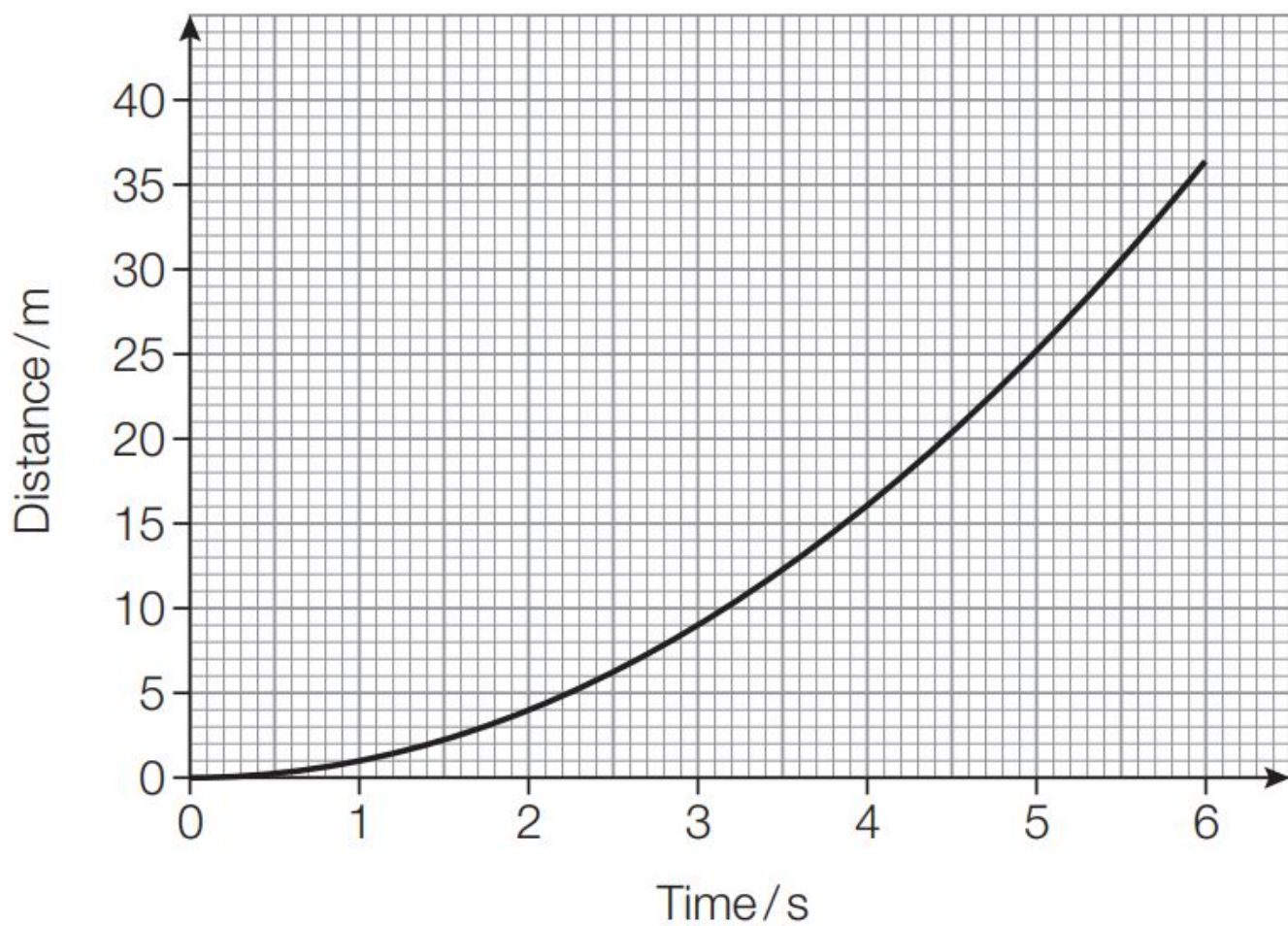
- (a) Decompose the velocity vector to horizontal and vertical one, calculate their magnitudes.(4 marks)
- (b) Find the maximum height the ball reaches, and find the time it spends to fly in the air.(4 marks)
- (c) How far will the ball reach horizontally?(2 marks)

12.(total=8 marks)A rope is used to pull a box a fixed distance s along a horizontal surface. The rope is at an angle θ to the horizontal and a constant force F is applied to the rope as shown.



Explain how the work done on the box by F varies as θ varies.

13.(total=12 marks)The graph shows how displacement varies with time for an object that starts from rest with constant acceleration.

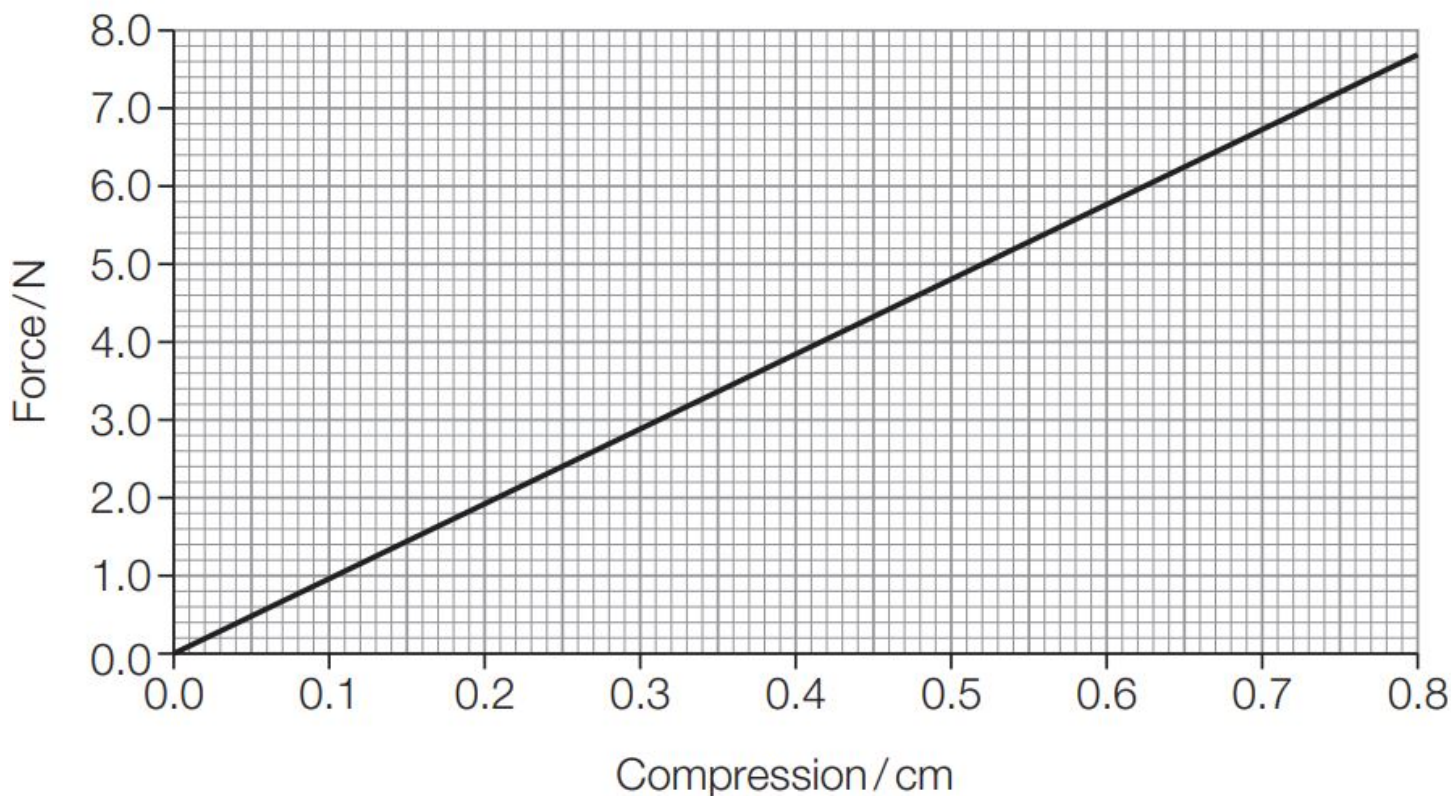


- (a) Use the graph to determine the speed of the object at a time of 4.0 s.(4 marks)
- (b) Calculate the acceleration.(4 marks)
- (c) Try drawing the corresponding $v - t$ velocity-time graph.(4 marks)

14.(total = 20 marks) This is a device for swatting flies. The device consists of a handle, a spring and a disc as shown in the photograph below.



When the button is pushed, the compressed spring is released, launching the disc at the fly.



- (a) Calculate the stiffness constant of this spring, rounded to the nearest integer.(3 marks)
- (b) The spring is 6.3 cm long. When it is compressed in the device, the length of the spring is reduced to 1.6 cm. Find the energy stored in the spring.(3 marks)
- (c) The disc and spring have a combined mass of 9.4 g. Show that the maximum speed at which they can be launched is about 15 m/s.(3 marks)
- (d) The disc is launched horizontally at a fly on the wall 3.0 m away. Ignore the effects of air resistance.
1. How long will it fly before hitting the wall?(2 marks)
 2. Calculate the velocity of the disc when it hits the wall. (4 marks)
 3. The fly is 20 cm below the horizontal level at which the disc is launched. Show that the disc is close enough to hit the fly if it does not move. The disc has a radius of 3 cm. (4 marks)
- (e) Suggest an advantage of the disc used over a solid disc.(1 mark)

15.(total = 10 marks) Gravitational field strength on earth, denoted by **g** on earth, is defined as the force per unit mass, in mathematical term: $g = F/m$. The SI unit is N/kg and it's a vector quantity.

(a) An iron ball, a light gate and other necessary equipment are provided, try designing an experiment for measuring **g**. Necessary diagram and formulas should be provided.(8 marks)

(b) Suggest one method to reduce error.(2 marks)

