

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: 75 minutes

Full Score: 100 points

Name _____

Score _____

Section A

Every question in this Section is worth 5 marks, and there will be only 1 correct option to each one.

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
C.	speed	distance
D.	velocity	speed

4.(____) A ball is thrown vertically upwards at a speed of 9.81m/s . What is the maximum height it reaches rounded to the nearest cent?

- A. 9.81m
- B. 4.91m
- C. 19.62m
- 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?

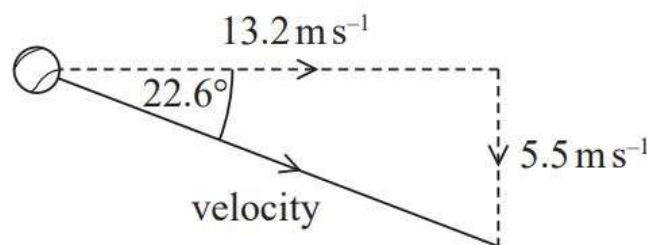
- A. $5.8\text{ kg} \cdot \text{m/s}$
- B. $4.1\text{ kg} \cdot \text{m/s}$
- C. $1.8\text{ kg} \cdot \text{m/s}$
- D. $410\text{ kg} \cdot \text{m/s}$

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. $\frac{12.2}{\sin(22.6^\circ)}$
- 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. 注意，物理术语拼写错误将按0分计答。

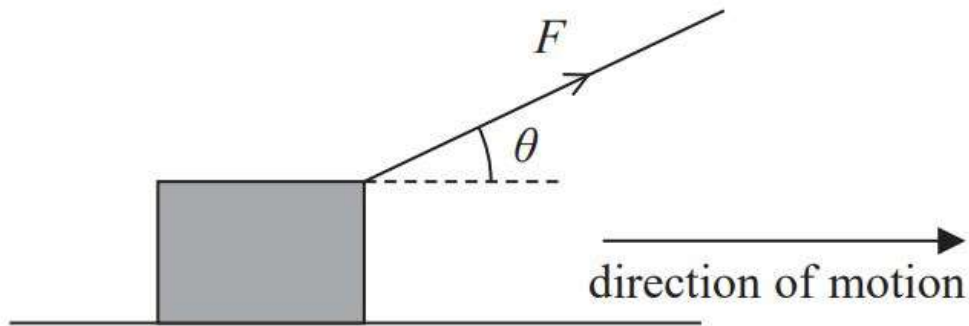
11.(total=10 marks) A boy in a stationary boat on a still pond has lost his oars(船桨) in the water. In order to get the boat moving again, he throws his bag horizontally out of the boat with a speed of 4m/s.

Mass of boat=60kg; mass of boy=40kg; mass of bag=5kg.

(a) How fast will the boat move?(6 marks)

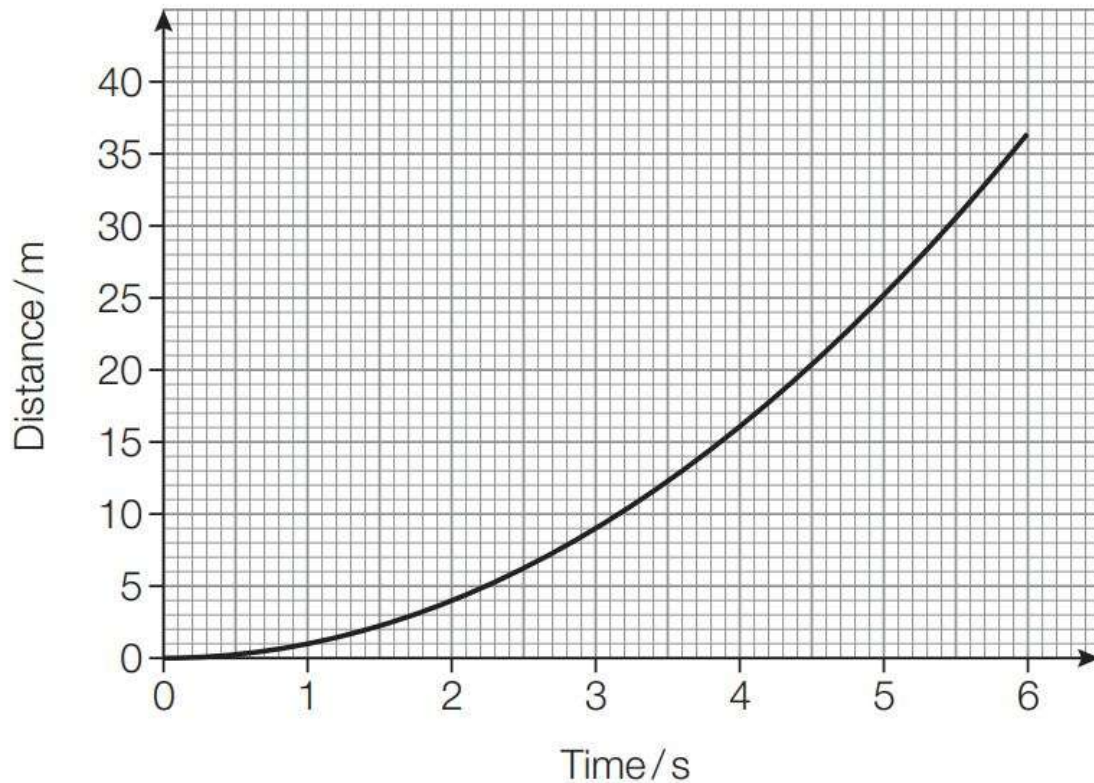
(b) If he throws the bag by exerting a force on it for 0.2s, how much force does he exert?(4 marks)

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 distance–time 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) The photograph shows a wind turbine. Kinetic energy of the wind is transferred to electrical energy as the turbine blades rotate.



(a) Explain why we can say that the wind is doing work on the blades: (4 marks)

(b) The area swept out by one blade, as it turns through 360° , is 6000 m^2 . Wind at a speed of 9 m s^{-1} passes the turbine. (3 marks each)

1. Show that the volume of air passing through this area in 5 seconds is about $300,000 \text{ m}^3$.
2. Calculate the mass of this air. Density of air = 1.2 kg/m^3
3. Calculate the kinetic energy of this mass of air.
4. Betz's law states that a turbine cannot usefully transfer more than 59% of the kinetic energy of the wind.

Use this law to find the maximum output of the wind turbine.

(c) Suggest a reason why it is not possible to usefully transfer 100% of the kinetic energy of the wind. (2 marks)

(d) Suggest the limitations of using wind turbines to provide power. (2 marks)

