Anglo-Chinese School (Independent)



FINAL EXAMINATION 2020 YEAR 3 INTEGRATED PROGRAMME

PHYSICS

PAPER 1

Tuesday

6 October 2020

1 hour

INSTRUCTIONS TO STUDENTS

Write and shade your index number in the box provided on the OTAS sheet.

Do not open this booklet until you are told to do so.

INFORMATION FOR STUDENTS

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.

Choose the **one** you consider correct and record your choice using **2B soft pencil** to shade in the OTAS sheet provided.

Calculators are allowed for this paper. Take g = 10 N/kg or 10 m s^{-2} .



There are **16** printed pages.

Multiple Choice Questions [40 Marks]

- 1. Which physical quantity listed below is a scalar quantity?
 - A acceleration
 - **B** force
 - C mass
 - **D** velocity
- 2. A student attempts to measure the period of oscillation of a pendulum in a laboratory which is located at 10 m above sea level. The average value of the period of oscillation is determined to be 1.6 s. He then repeats the same experiment from a height of 5 m above sea level, using a pendulum bob with half the mass but keeping the length of the pendulum constant. Which is the most likely value of the period of oscillation measured in the second attempt?
 - A
 0.4 s

 B
 0.8 s

 C
 1.6 s

 D
 3.2 s
- 3. A student determines the circumference of a golf ball. Which instrument directly measures the circumference of the golf ball?
 - A calipers
 - **B** micrometer
 - C rule
 - **D** tape
- 4. Paths are laid as shown between points X, Y and Z.



A person walks along the paths from X to Y to Z and then back to X. What is the value of the total displacement and of the total distance travelled?

	total displacement / m	total distance travelled / m
A	0	0
B	0	24
С	24	0
D	24	24

5. A car travels along a road. The driver stops the car by pushing his foot down on the brake pedal. What does not change if he pushes harder on the brake pedal?



- **A** the braking distance
- **B** the braking force
- **C** the stopping distance
- **D** the thinking distance
- 6. An object is thrown vertically upwards from point A with an initial velocity. It travels to the highest point B and then falls back to A. Neglecting air resistance, which one of the following statements is incorrect?
 - **A** The acceleration of the object is constant throughout the motion.
 - **B** The time for the upward motion is longer than the time for the downward motion.
 - **C** The total displacement of the object is zero.
 - **D** The velocity of the object at the highest point is zero.
- 7. What is the size of the resultant of the two forces shown in the diagram?



8. The diagram shows the velocity-time graph of an object. Which one of the following statements about the object is true?



- **A** It returns to its starting point after 25 seconds.
- **B** Its acceleration in the first 10 seconds is 2.0 m s^{-2} .
- **C** The object stops moving from t = 10 s to t = 20 s.
- **D** The total distance travelled is 250 m.
- 9. A car is accelerating along a straight, horizontal road. The diagram shows forces acting on the car.



Which forces are balanced?

- A contact forces and air resistance
- **B** contact forces and weight
- **C** driving force and air resistance
- **D** driving force and weight

10. A body slides up a frictionless slope, as shown.As the body presses on the surface, the surface pushes back on the body.In which direction does the surface push back on the body?



- 11. An object falls from rest through the air and the air resistance on it increases. The object reaches terminal velocity. Which quantity decreases until its terminal velocity is reached?
 - A acceleration
 - **B** kinetic energy
 - C speed
 - **D** weight
- 12. A spacecraft travels from the Earth to the Moon. At a certain point in the journey, it has zero weight. Why is the weight zero at this point?
 - **A** The gravitational fields of the Earth and the Moon cancel each other.
 - **B** The spacecraft leaves the Earth's gravitational field.
 - **C** The spacecraft stops moving.
 - **D** There is no air resistance on the spacecraft.
- 13. A person of weight 600 N at the bottom of a mountain climbs to the top. The gravitational field strength changes from 10.00 N kg⁻¹ at the bottom to 9.97 N kg⁻¹ at the top.

What are his mass and his weight at the top of the mountain?

	mass at top of mountain / kg	weight at top of mountain / N
A	60.0	598
B	60.0	600
С	60.1	598
D	60.1	600

14. A turning effect is applied to a tap as shown.



What is the magnitude of the resultant moment?

- **A** $\frac{Fd}{2}$ **B** Fd **C** 2Fd **D** 4Fd
- 15. A wooden trapdoor is hinged along one side and, when closed, is supported on the other side by a ledge.



When the trapdoor is closed, the ledge exerts an upward force of 15 N on the trapdoor. What is the weight of the trapdoor?

A 1.5 N **B** 3.0 N **C** 30 N **D** 150 N

- 16. What affects the stability of an object?
 - A only its base area
 - **B** only its base area and the location of its centre of mass
 - **C** only its weight and its base area
 - **D** only the location of its centre of mass

17. A student wants to find the centre of mass of a triangular lamina PQR. He drills a small hole at Q. He suspends the lamina from a pin through the hole at Q so that the lamina swings freely. He then hangs a plumb-line from the pin at Q, as shown. He marks the position of the plumb-line on the lamina.



To determine the location of the centre of mass, the student then repeats the experiment but with one change. What is the change?

- **A** He suspends the lamina from the hole at Q, with R on the left and P on the right.
- **B** He suspends the lamina from a pin through a hole at R.
- **C** He uses a heavier weight on the plumb-line.
- **D** He uses a longer plumb-line.
- 18. The work done by a force on a body is calculated by multiplying the force by a quantity. Which quantity is this?
 - **A** The distance travelled in the direction of the force
 - **B** The distance travelled perpendicular to the direction of the force
 - **C** The speed in the direction perpendicular to the force
 - **D** The velocity in the direction of the force
- 19. A motor is used to lift a load 5.0 m vertically, as shown.



The load weighs 40 N. The power of the motor is 200 W and the system is 25% efficient. How long does it take to raise the load?

A 0.040 s **B** 0.25 s **C** 1.0 s **D** 4.0 s

20. The diagram represents a geothermal power station.



Which useful energy transformation is taking place?

- A electrical energy \rightarrow potential energy
- **B** electrical energy \rightarrow thermal energy
- **C** potential energy \rightarrow electrical energy
- **D** thermal energy \rightarrow electrical energy
- 21. Bubbles of air, moving from the bottom of a swimming pool to the top surface is shown in the figure below. As the bubble rise, it get larger in size.



The change in size of the bubble occurs because

- **A** both atmospheric pressure and liquid pressure on the bubble decreases.
- **B** atmospheric pressure on the bubble remains same and the liquid pressure on the bubble decreases.
- **C** liquid pressure on the bubble increases.
- **D** weight of the bubble decreases.

22. The hydraulic system shown in the diagram contains an incompressible liquid. There are few air bubbles in the liquid. A downward force F_1 of 10 N is exerted on the smaller piston. If the ratio of area of the smaller to larger piston is 1:10, what will be the most likely upward force on the larger piston?



23. The diagram below shows a simple mercury manometer connected to a gas supply.



Which statement is correct?

- **A** The pressure at point 1 equals to the pressure at point 4.
- **B** The pressure at point 2 is lesser than the pressure at point 3
- **C** The pressure at point is 1 lesser the pressure at point 5.
- **D** The pressure at point 5 is lowest compared to the other points.

24. A rectangular metal block of mass 500 g is placed on the ground as shown in the figure below. What is the pressure exerted by the metal block on the ground in Pa?



D 1670

Α

B

С

25. A fixed mass of a gas is heated in a container with a movable frictionless piston. How have the properties of the gas molecules change when the piston stops moving?

	Frequency of collisions	Force exerted by molecules	Average distance
	with walls	on the wall of the container	between molecules
Α	increases	decreases	remains same
В	decreases	increases	increases
С	increases	increases	remains same
D	increases	increases	increases

26. A student observes the Brownian motion of smoke particles in air with a microscope. He sees small points of light moving around as shown in diagram 2.



What does this experiment demonstrate about air molecules and smoke particles?

- A Smoke particles gives out light when they collide with each other.
- **B** Air molecules give out light when they collide with smoke particles.
- **C** Air molecules move about randomly at high speeds
- **D** Air molecules move because of collisions with smoke particles.

- 27. Ice cubes are used to lower the temperature of a glass of juice. What is the main process by which the juice at the bottom of the glass cools?
 - A conduction
 - **B** convection
 - C radiation
 - **D** evaporation
- 28. The diagram below shows how the process of convection leads to a breeze coming off the sea during daytime.



Which one of the following is true during the process of convection at daytime?

- A pressure is low at region A
- **B** pressure is high at region B
- **C** pressure is low at region B
- **D** air particles above the land heated up faster as the specific heat capacity of the land is greater than the specific heat capacity of sea water.
- 29. A thermocouple records an e.m.f. of 5.00 mV with one junction in melting ice and the other in boiling water, at normal atmospheric pressure. When the hot junction is taken out of the boiling water and then placed in a Bunsen flame, it records an e.m.f. of 24.00 mV. If the room temperature is 25°C, what is the temperature of the flame?

Α	4.8 °C
B	20.8 °C
С	480 °C
D	505 °C

30. A mercury-in-glass thermometer has only markings -10 °C and 110 °C. The diagram below shows the mercury thread when this thermometer is immersed in a beaker of water. What is the temperature of the water?



- 31 During the vaporization process, when water changes to vapour, there is no change in temperature even though energy is supplied. This is because
 - Α energy is required to form a bond between water molecules.
 - B energy is required to compensate the heat loss to the environment
 - С energy is required to overcome the intermolecular forces between the water molecules and the pressure exerted by the atmosphere.
 - D energy is required to increase the intermolecular forces between the vapour molecules
- 32. In an experiment to find the specific heat capacity of a metal, it is found that 2.0 kJ of thermal energy is needed to raise the temperature of a 500 g metal block by 10 °C. What is the specific heat capacity of the metal?
 - $0.400 \text{ J kg}^{-1} \circ \text{C}^{-1}$ Α
 - 4.00 J kg⁻¹ °C⁻¹ 200 J kg⁻¹ °C⁻¹ 400 J kg⁻¹ °C⁻¹ B
 - С
 - D

- 33. Why do people feel cool if they do not dry themselves after swimming in the sea?
 - **A** Water is colder than air.
 - **B** Water is a poor conductor of heat.
 - **C** Water evaporates and causes cooling.
 - **D** Specific heat capacity of the water is lower than specific heat capacity of the human being.
- 34. A person running in a race generates a power of 800 W. Half of this power is lost from the body by the evaporation of water. What is mass of water evaporated from the body in a 2.0 hours race, given that the specific latent heat of vaporisation of water at body temperature is 2.4×10^6 J kg⁻¹.
 - A 0.42 kg
 - **B** 0.83 kg
 - **C** 1.2 kg
 - **D** 2.4 kg
- 35. The heating curve of a substance in solid state that is initially at 5°C is shown in the figure below. The heating source provides a constant rate of thermal energy to the solid. Heat loss to the surroundings is also negligible.



Which one of the following statements is true?

- A The potential energy of the substance remains constant at t = 5.0 mins to t = 15 mins.
- **B** The total internal energy of the substance remains constant at t = 0.0 mins to t = 45 mins.
- **C** The specific heat capacity of the substance increases linearly during the solid state.
- **D** The specific latent heat of vaporisation of the substance is greater than the specific latent heat of fusion.

36. The graph shows the temperature-time graph for a sample of material X and Y. Mass of the samples are identical and same amount energy is supplied for a period of time.



Which one of the following statements is true?

- A material X has lower heat capacity.
- **B** material X has higher specific heat capacity.
- **C** material Y has higher heat capacity.
- **D** material Y has higher specific heat capacity.
- 37. Six students are standing in a straight line in front of the mirror. The students are spaced equally apart from each other and student 3 from the right is standing directly in front of the edge of the mirror.



How many students will the student 1 be able to see in the mirror including himself?

A 3
B 4
C 5
D 6

38. The figure below shows how a ray of light from an object O enters the eye after being reflected twice. Mirror A is parallel to mirror B. Determine the perpendicular distance of the image of object O from the mirror B as seen by the eye.



39. Two prisms A and B are placed in the periscope as shown in the figure below. An object O is placed near the prism A. The light rays from the object are totally internally reflected by both prisms before reaching the observer's eye.



Which one of the following best describes the image of the object seen by the observer?

- A real, upright, and same size
- **B** virtual, upright, and same size
- **C** virtual, upright and magnified
- **D** virtual, inverted, and same size

40. A ray of light enters from air into medium 1 and medium 2, and eventually emerges into air again as shown in the figure below.



Which of the following statement(s) is/are correct?

- (i) Speed of the light ray in medium 1 and 2 are the same.
- (ii) Refractive index of medium 1 and 2 are the same.
- (iii) Angle of incidence is equal to the angle of refraction at the boundaries of the medium 1 and 2.
- A (i) and (ii) only
- **B** (i) and (iii) only
- C (ii) and (iii) only
- **D** (i), (ii) and (iii)

[END OF PAPER]