



Hwa Chong Institution Examinations
Secondary 3 Integrated Programme

CANDIDATE
NAME

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CLASS

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REGISTER
NUMBER

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PHYSICS

October 2020

Paper 1 Multiple Choice

45 mins

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, class and register number on the Answer Sheet in the spaces below unless this has been done for you.

DO NOT WRITE IN ANY BARCODES

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

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

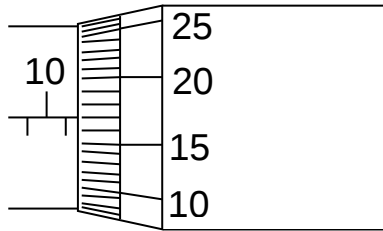
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in the question booklet.

The use of an approved scientific calculator is expected, where appropriate.

- 1 The radius of a hydrogen nucleus is 1×10^{-15} m. Which of the following may the radius be expressed in?

A 1×10^{-6} nm
 B 1×10^{-5} nm
 C 1×10^{-3} nm
 D 1×10^{-2} nm

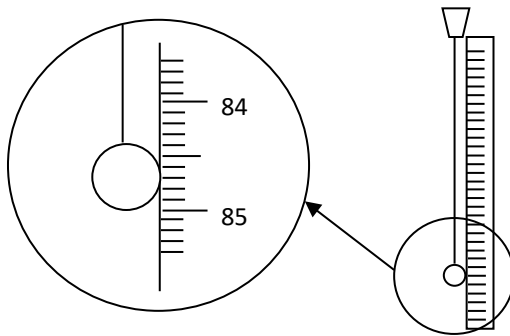
- 2 The figure below shows a section of a micrometer screwgauge when a ball-bearing was gripped between the anvil and the spindle.



If the instrument has a zero reading of $+0.02$ mm, what is the actual diameter of the ball bearing?

A 10.15 mm
 B 10.19 mm
 C 10.65 mm
 D 10.69 mm

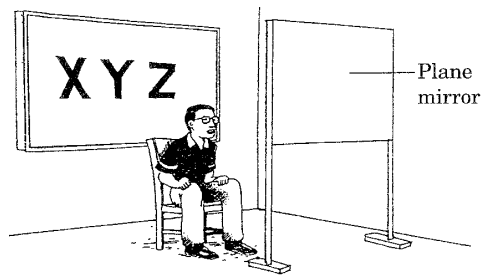
- 3 Mr Anderson is measuring the length of a pendulum in an experiment as shown in the figure below.



What is the length of the pendulum?

A 84.4 cm
 B 84.5 cm
 C 84.7 cm
 D 85.0 cm

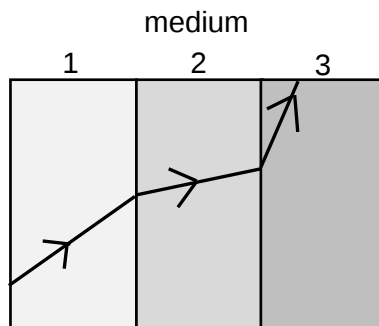
- 4 The figure below shows a student looking at a plane mirror.



Which of the following shows the image observed by the student in the plane mirror?

- A
- B
- C
- D

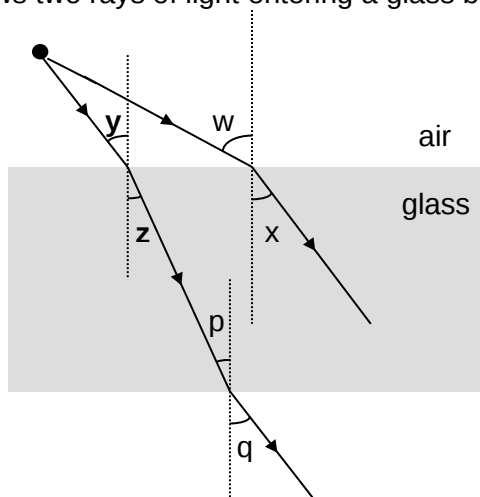
- 5 A light ray travels from medium 1 to medium 3 as shown in the figure below.



Which of the following list the mediums in order of increasing refractive index?

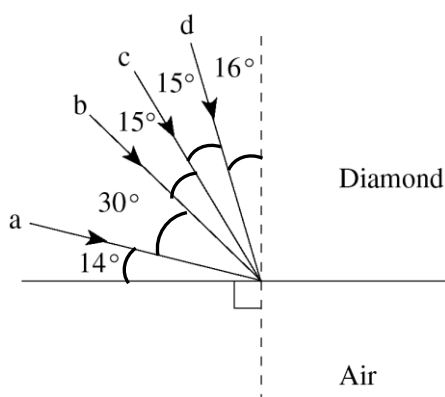
- A medium 1, medium 2, medium 3.
 B medium 1, medium 3, medium 2.
 C medium 2, medium 3, medium 1.
 D medium 3, medium 1, medium 2.

- 6 The figure below shows two rays of light entering a glass block.



Which of the following relationship is correct?

- A** $\frac{w}{x} = \frac{y}{z}$
- B** $\frac{\sin w}{\sin x} = \frac{\sin q}{\sin p}$
- C** $\frac{\sin y}{\sin z} = \frac{\sin p}{\sin q}$
- D** $\frac{\sin w}{\sin x} = \frac{\sin z}{\sin y}$
- 7 Several rays of light traveling in a diamond approached the diamond – air interface at different angles. The magnitude of the angles between the light rays are shown in between the arrows as shown in the figure below. The refractive index of diamond is 2.46.

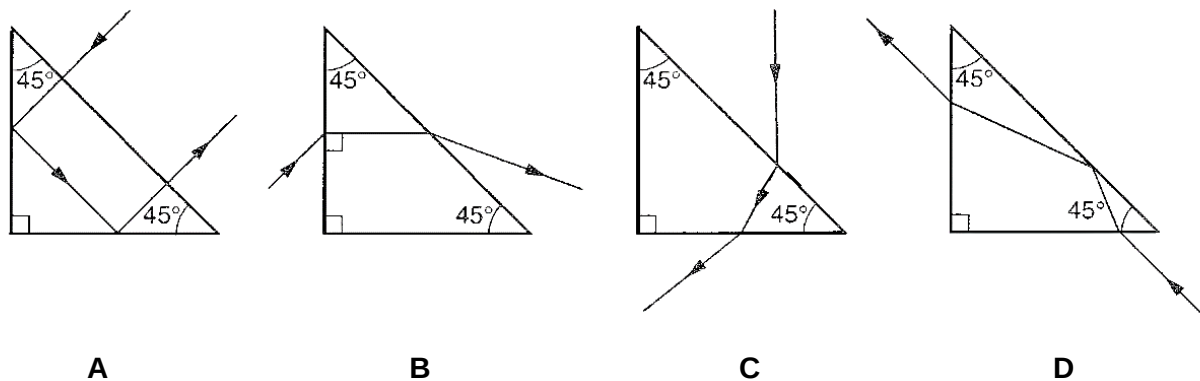


Which of the light ray(s) shown will undergo total internal reflection?

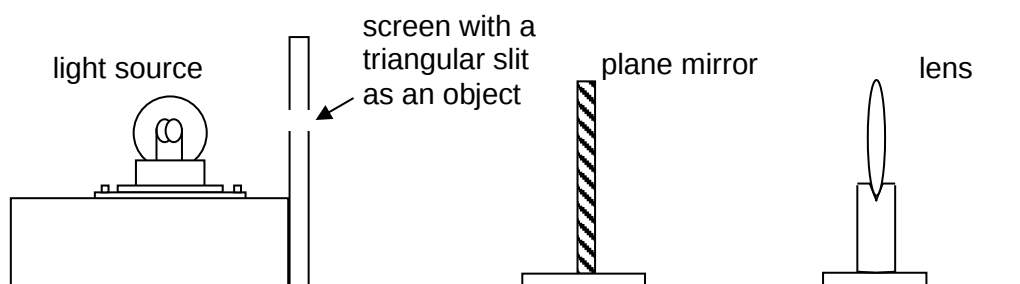
- A** a only.
- B** a, b and c.
- C** b, c and d.
- D** d only.

- 8 The diagrams below show four similar glass prisms (not drawn to scale). The critical angle between the glass prism and air is less than 45° .

Which diagram, showing light passing through the prism is **not** correct?



- 9 The diagram below shows some randomly placed apparatus in a Physics Lab.



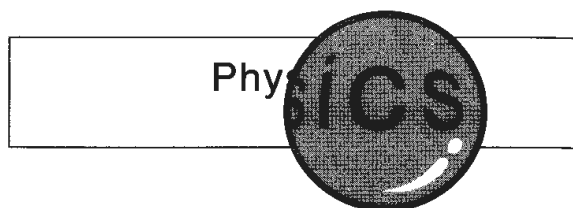
The following is a list of steps taken by the pupil to find the focal length of a convex lens.

- (1) Move the object to and fro until a sharp image is formed side by side with it on the screen.
- (2) Place a plane mirror behind the lens and the screen.
- (3) Measure the distance between the lens and the screen.
- (4) Measure the distance between the light source and the plane mirror.

Which of the following shows the steps in correct order?

- A** (2), (1), (3).
B (2), (1), (4).
C (1), (2), (3).
D (1), (3), (2).

- 10 A lens is used to read some small print on a book as shown in the figure below.



Which of the following statements is **incorrect**?

- A The image of the small print is real.
 - B The image distance is longer than the object distance.
 - C The object distance is shorter than the focal length of the lens.
 - D The small print and its image are on the same side of the lens.
- 11 Which pair includes a **vector** quantity and a **scalar** quantity?

	Vector	Scalar
A	Displacement	Acceleration
B	Force	Kinetic energy
C	Power	Speed
D	Work	Potential energy

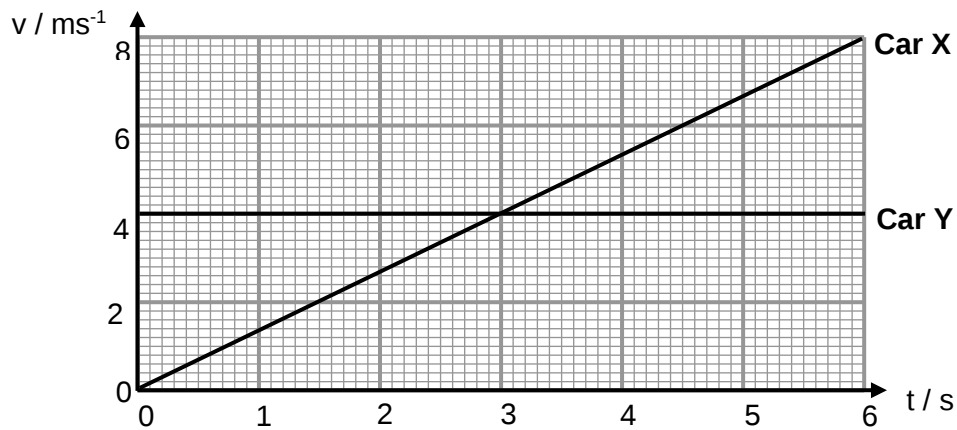
- 12 Two forces of magnitudes 3.5 N and 4.5 N act on a point mass. Which of the following **cannot** be the resultant of the two forces?
- A 0.5 N
 - B 1.5 N
 - C 4.0 N
 - D 7.0 N

- 13 Which of the following shows the components of the electromagnetic spectrum, arranged in the order of increasing wavelength?

→ Increasing wavelength		
A	radio waves	visible light
B	visible light	microwave
C	gamma rays	radio waves
D	X-rays	visible light

X-rays
gamma rays
microwaves
microwaves

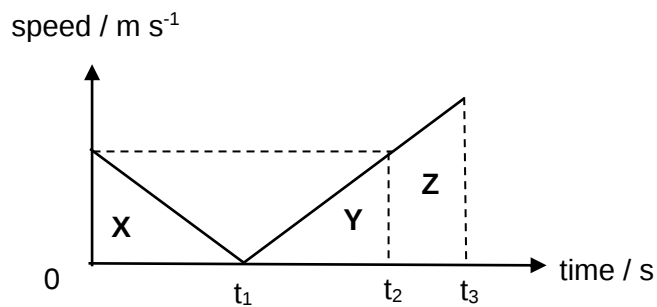
- 14 The speed-time graphs of car X and car Y are shown below. Both cars start from the same position.



At what time will the two cars meet?

- A 3 s
B 4 s
C 5 s
D 6 s
- 15 A man, standing on the top of a cliff by the sea, threw a stone upwards. After some time, the stone hits the sea at the foot of the cliff.

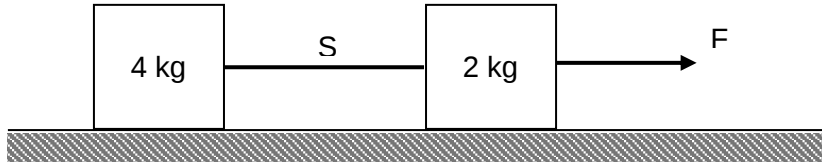
The graph below shows the variation of speed with time after the stone was thrown upwards. X and Y are the values of the area under each triangle while Z is the area of the trapezium from t_2 to t_3 .



Which of the following represents the height of the cliff above sea level?

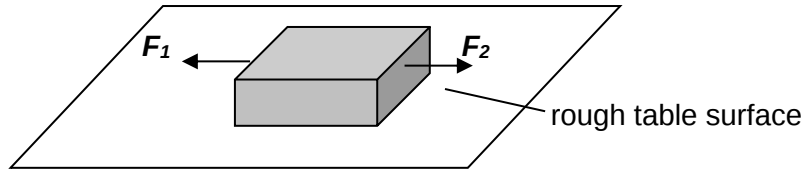
- A X
B $X + Y$
C Z
D $Y + Z$

- 16** The figure below shows two blocks connected by a light and inextensible string S. They move with uniform acceleration of 2 m s^{-2} under the action of a constant force F on a smooth surface.



What will be the acceleration of the blocks if S suddenly breaks?

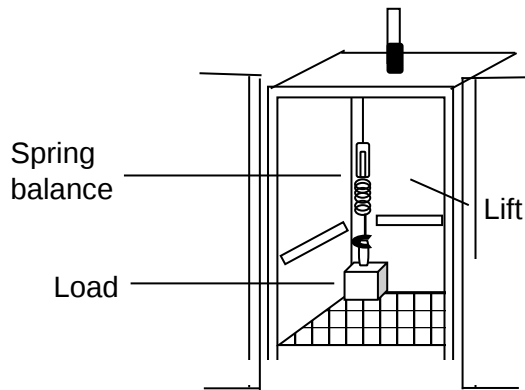
- | | 2 kg block | 4 kg block |
|----------|----------------------|----------------------|
| A | 6 m s^{-2} | 0 m s^{-2} |
| B | 6 m s^{-2} | 2 m s^{-2} |
| C | 2 m s^{-2} | 0 m s^{-2} |
| D | 2 m s^{-2} | 2 m s^{-2} |
- 17** The figure shows forces, F_1 and F_2 , exerted on a glass block placed on a rough table surface with a friction (maximum value) of 15 N.



Which pair of forces, F_1 and F_2 will cause the block to move with constant velocity?

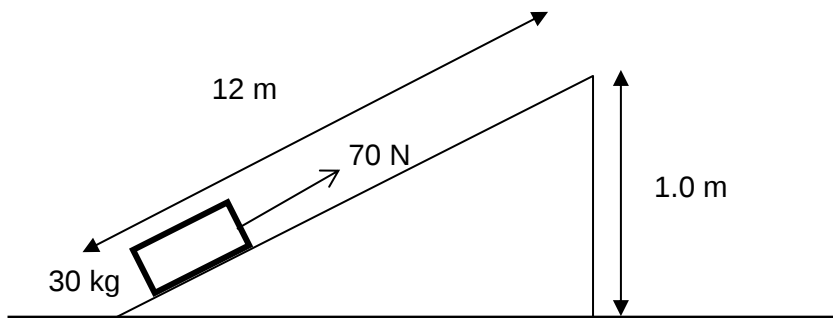
- | | F_1 / N | F_2 / N |
|----------|------------------|------------------|
| A | 30 | 10 |
| B | 40 | 55 |
| C | 60 | 15 |
| D | 70 | 70 |

- 18** The diagram below shows a load hanging on a spring balance in a stationary lift. The reading on the spring balance is 20 N.



During a section of a motion, the lift was accelerating downwards at 2.0 m s^{-2} . What is the reading of the spring balance?

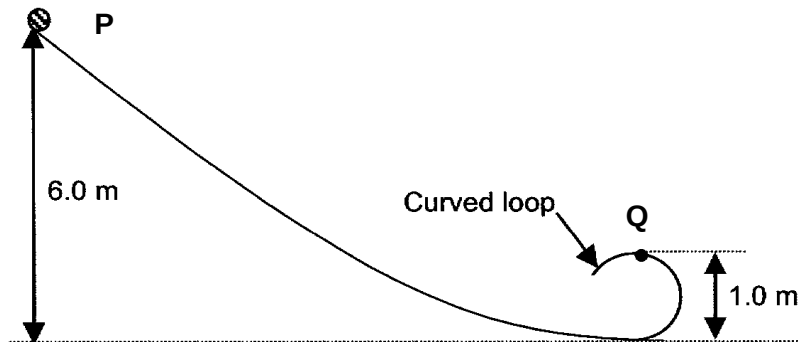
- A** 16 N
B 20 N
C 22 N
D 24 N
- 19** The figure below shows a block of mass 30 kg being pulled 12 m up a rough inclined plane at a constant speed. The force needed to do so is 70 N.



What is the work done against friction of the plane?

- A** 300 J
B 360 J
C 540 J
D 840 J

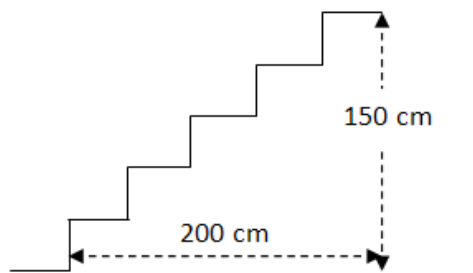
- 20 A ball bearing at **P** of mass 30 g slides from rest down a smooth track which has a curved loop as shown in the figure below.



What is the amount of kinetic energy and potential energy of the ball bearing at **Q**?

	Kinetic energy / J	Potential energy / J
A	0.30 J	1.5 J
B	1.5 J	0.30 J
C	1.5 J	1.8 J
D	1500 J	300 J

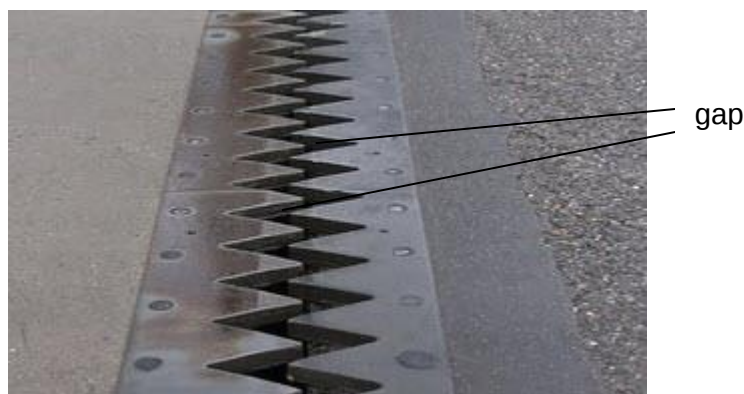
- 21 A boy of weight 600 N walks up a flight of stairs in 0.50 min as shown in the figure below.



What is the average power developed by the boy to lift himself up the stairs?

- A** 30 W
- B** 40 W
- C** 1800 W
- D** 2400 W

- 22 The diagram below shows a device placed between sections of a long bridge with a gap separating the two sections.

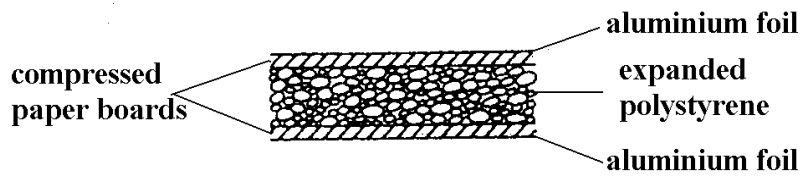


What is the purpose of the device?

- A It is a hump along the road to prevent speeding.
 - B It is a joint to prevent the road from cracking.
 - C It is a line to demarcate different parts of the road.
 - D It is a joint that allows wires and pipes to pass through.
- 23 A sealed air-filled balloon is squeezed slowly and the pressure of the air inside increases. Assuming the temperature of air inside is constant, which of the following statements about the air molecules is true?
- A The number of molecules increases.
 - B The molecules are moving at higher speed.
 - C The molecules increase in size.
 - D The molecules collide more frequently with the wall of the balloon.
- 24 Which of the following explains the energy changes when a solid is being heated and when the solid undergoes melting? (P.E. – Potential Energy; K.E. – Kinetic Energy)

	When solid is heated	During melting
A	K.E. and P.E. increase	K.E. and P.E. increase
B	K.E. increases only	K.E. increases only
C	K.E. increases only	P.E. increases only
D	P.E. increases only	K.E. increases only

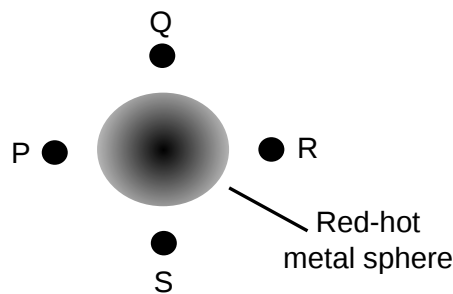
- 25 The figure represents a section through a particular type of building board.



Which one of the following shows why the board provides good heat insulation?

	Aluminium foil is	Expanded polystyrene is
A	a good reflector.	a poor conductor.
B	a poor reflector.	a poor conductor.
C	a good conductor.	a good reflector.
D	a good conductor.	a poor reflector.

- 26 The figure below shows a red-hot metal sphere in air. Four sensitive thermometers are placed at the same distance from the sphere at P (on the left), Q (at the top), R (on the right) and S (at the bottom).



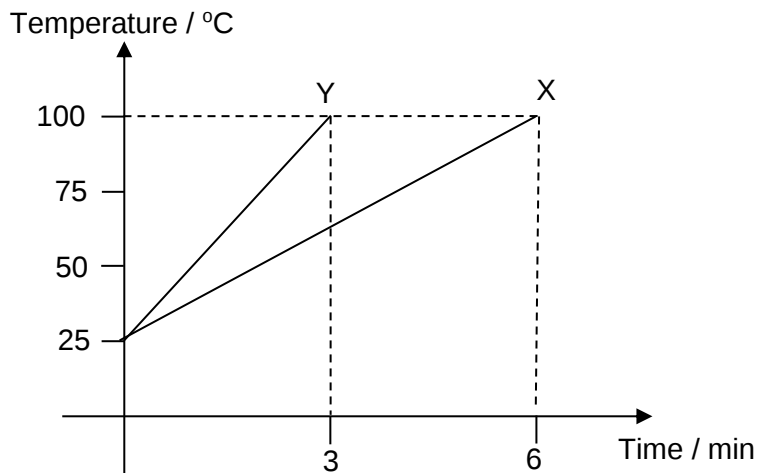
Which thermometer would give the highest reading?

- A** P
B Q
C R
D S
- 27 Which of the following is essential in the design and calibration of a thermometer?
- A** has a varying rate of expansion.
B has a property that remains solid all the time.
C has a property that varies with temperature linearly.
D remains liquid over the entire range of temperatures to be measured.
- 28 A thermocouple indicates 0.2 mV at the ice point and 3.5 mV at 600 °C. What will be the temperature when the thermocouple indicates – 1 mV?
- A** – 218 °C
B – 182 °C
C – 145 °C
D – 36.4 °C

- 29 6 000 J of thermal energy is needed to bring a 3.0 kg metal block from 25 °C to 35 °C. Find the heat capacity and specific heat capacity of the block.

	<i>Heat capacity / J K⁻¹</i>	<i>Specific heat capacity / J kg⁻¹ K⁻¹</i>
A	200	600
B	600	200
C	600	1800
D	1800	600

- 30 The ratio of the masses of two metal blocks X and Y is 1: 2. They are both heated uniformly using identical heaters. The temperature-time graphs of the blocks are shown below.



What is the ratio of the specific heat capacities of X and Y?

- A 1:1
 B 1:2
 C 2:1
 D 4:1

END