NORTH VISTA SECONDARY SCHOOL
End-of-Year Examination 2025
Secondary 3 Express

40

CANDIDATE NAME

CLASS

INDEX NUMBER

PHYSICS

6091/01

3 October 2025

1 hour

Paper 1 Multiple Choice

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction tape/fluid.
Write your full name, register number and class on the Answer Sheet in the spaces provided unless this has been done for you.

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

1 Which quantity is a base quantity?

A charge
B force
C temperature
D weight

2 A pendulum clock is found to lose 10 minutes per day.

Which action can correct this clock?

A decreasing the amplitude of oscillation
B increasing the amplitude of oscillation
C decreasing the length of pendulum
D increasing the length of pendulum

3 A student determines the density of a solid metal cube.

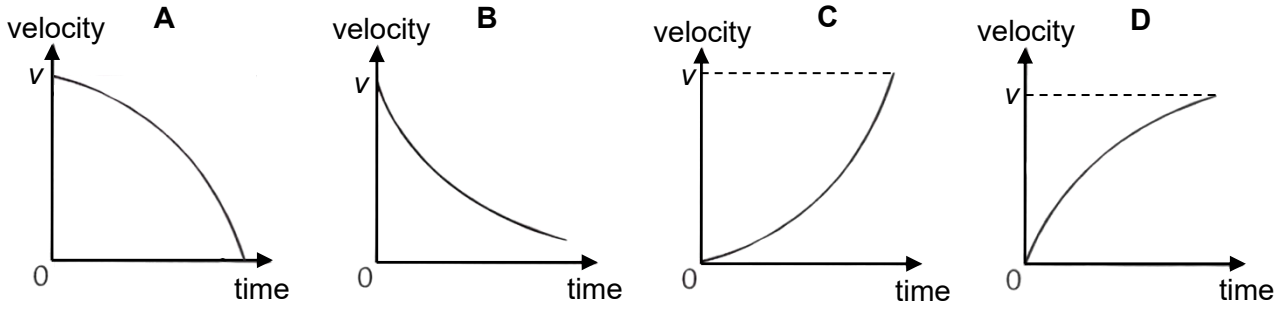
Which pieces of equipment does the student use?

A a balance and a force meter
B a balance and a ruler
C a micrometer and a measuring cylinder
D a ruler and a measuring cylinder

4 A car decelerates from velocity *v*.

The deceleration gradually increases.

Which graph shows how the velocity of the car changes?



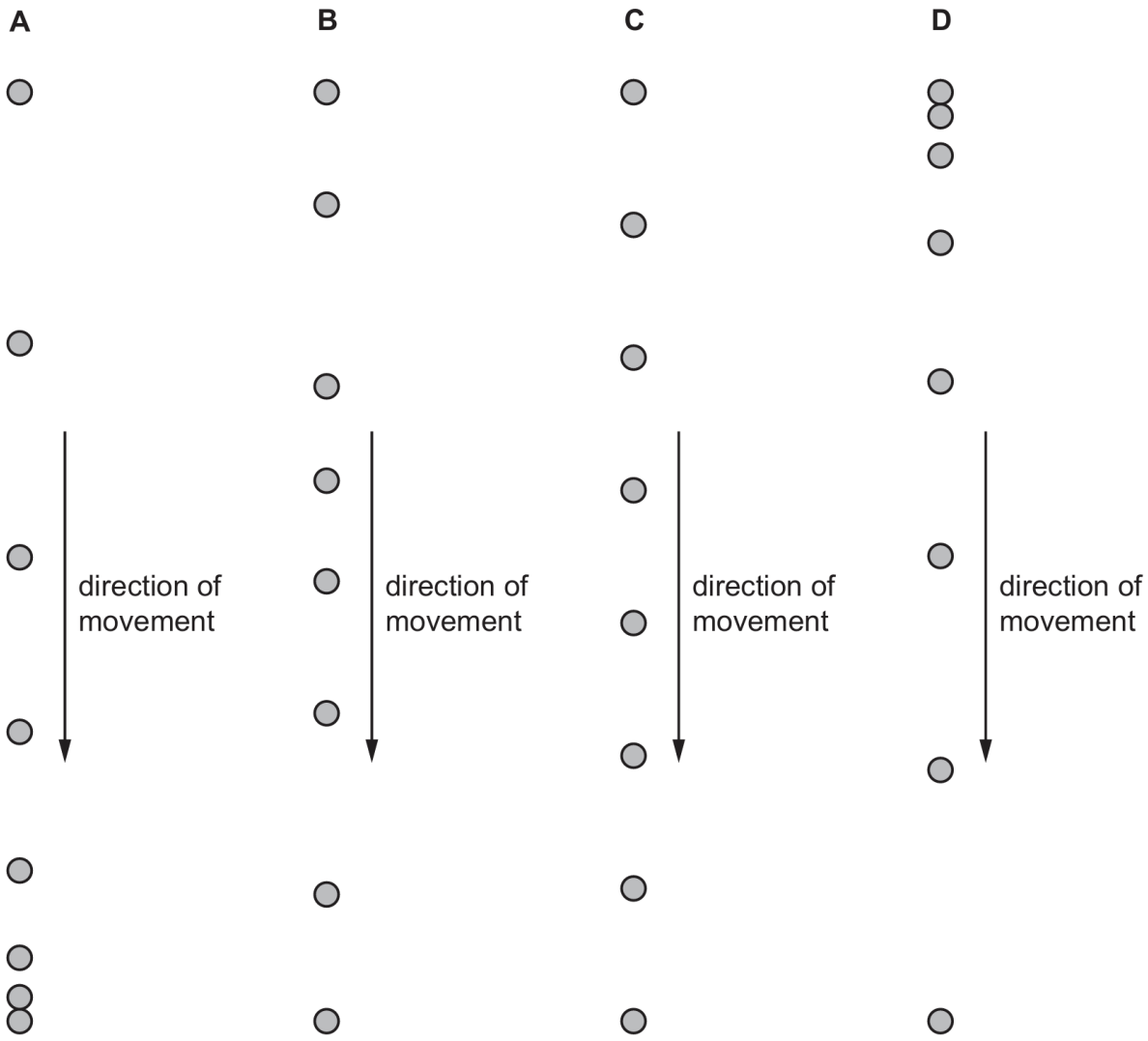
5 A cyclist, riding at a speed of 5.0m/s, brakes with uniform deceleration and stops in 3.0m.

How long does the cyclist take to stop?

A 0.60s **B** 1.2s **C** 1.3s **D** 3.0s

6 An object falls in air. Its position at equal time intervals is shown by a sequence of dots.

Which sequence of dots is correct?



7 Which statement about gravitational field is correct?

A It is a region affected by the medium through which a mass travels.

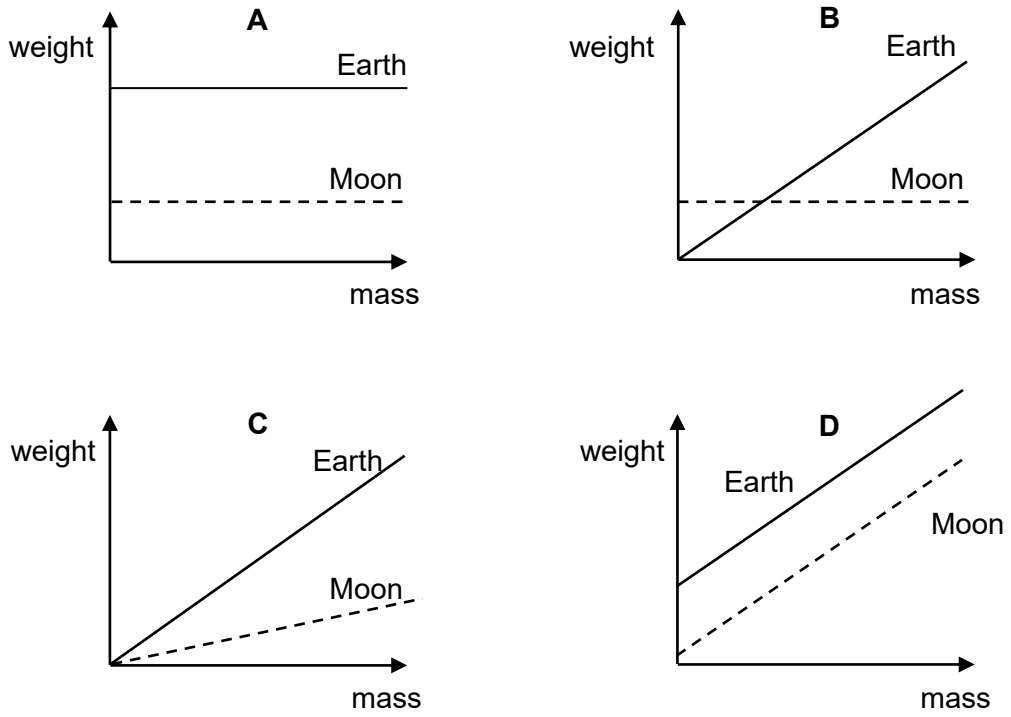
B It is a region where a mass experiences a force due to gravitational attraction.

C It is a region where a force experiences gravitational attraction due to its mass.

D It is a region which only exists around large masses.

8 An astronaut measures the mass and the weight of various objects on the Earth and the Moon.

Which diagram shows the correct graph of weight against mass for the various objects on the Earth and Moon?



9 When a solid A of mass 12g is immersed in a measuring cylinder filled with water, it displaces the same volume of water as a solid B of mass 8g.

What can be deduced about the densities of solids A and B ?

A Both A and B have the same density.

B The density of A is one and half times the density of B.

C The density of A is greater than B by a factor of 4.

D The density of A is less than B by a factor of 4.

10 What must be changing when a body is accelerating uniformly?

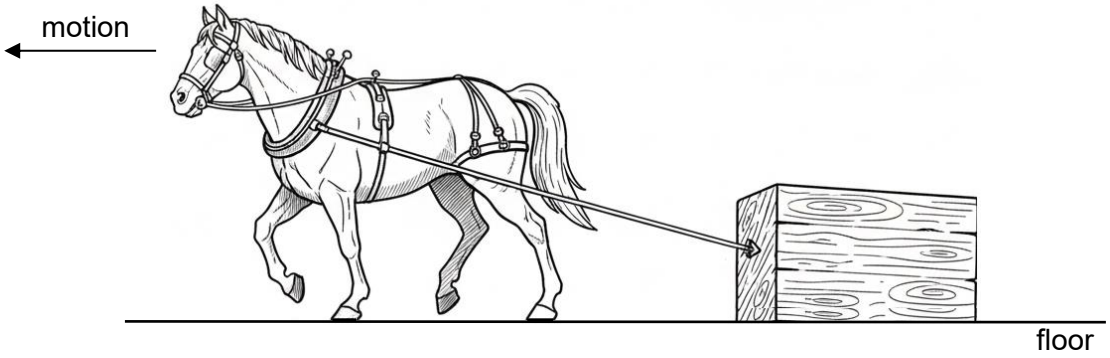
A direction of the body

B force acting on the body

C speed of the body

D velocity of the body

11 A horse pulls a block along a rough horizontal floor.



A force acts in the rope between the horse and the box.

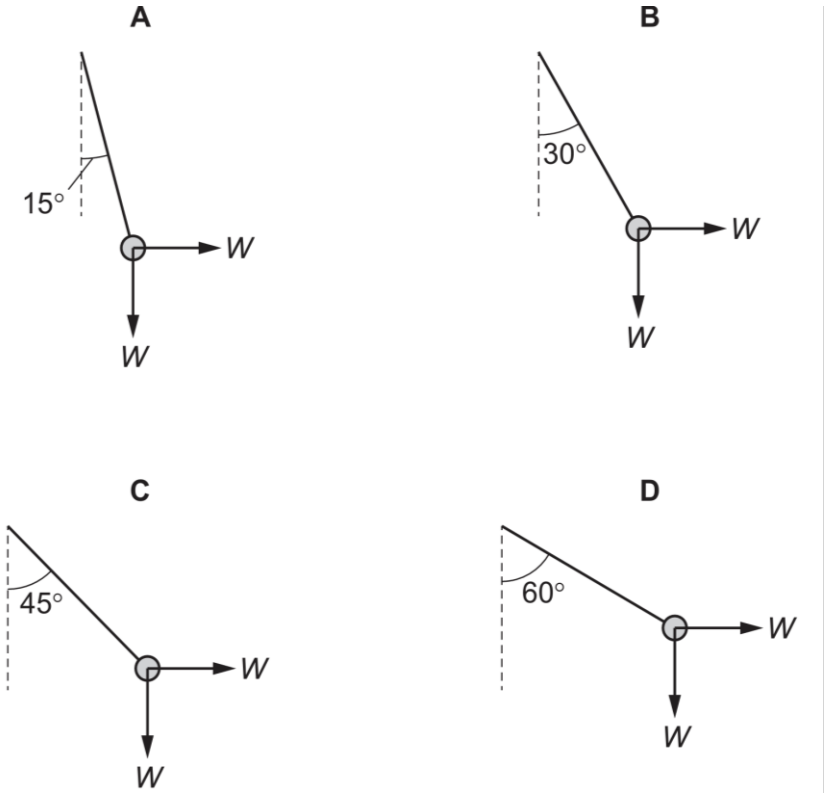
Another force acts between the horse's feet and the floor.

In which direction do these forces act on the horse?

	force in the rope on horse	force on horse's feet
A	towards the left	towards the left
B	towards the left	towards the right
C	towards the right	towards the left
D	towards the right	towards the right

12 The bob of a simple pendulum is pulled horizontally by a force that is equal to the weight *W* of the bob.

Which diagram shows the angle between the pendulum thread and the vertical?



13 A Bunsen burner is a very stable object.

Why is this so?

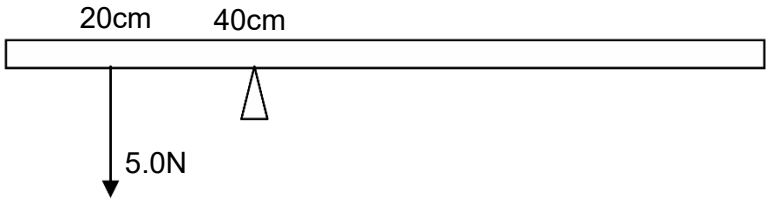
A It has a high centre of gravity and broad base.

B It has a high centre of gravity and narrow base.

C It has a low centre of gravity and broad base.

D It has a low centre of gravity and narrow base.

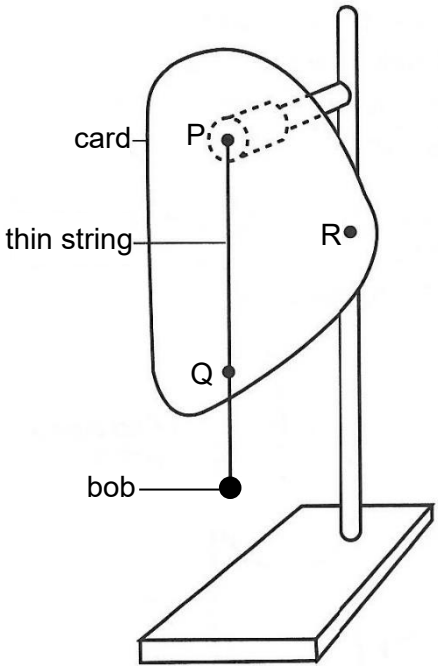
14 A uniform metre rule is balanced at the 40cm mark by a 5.0N downward force acting at the 20cm mark.



What is the mass of the metre rule?

A 0.20kg **B** 0.50kg **C** 2.0kg **D** 1.0kg

15 The diagram below shows the first step in an experiment to determine the position of the centre of mass of a thin card.



What is the next step in this experiment?

A find the midpoint of PQ

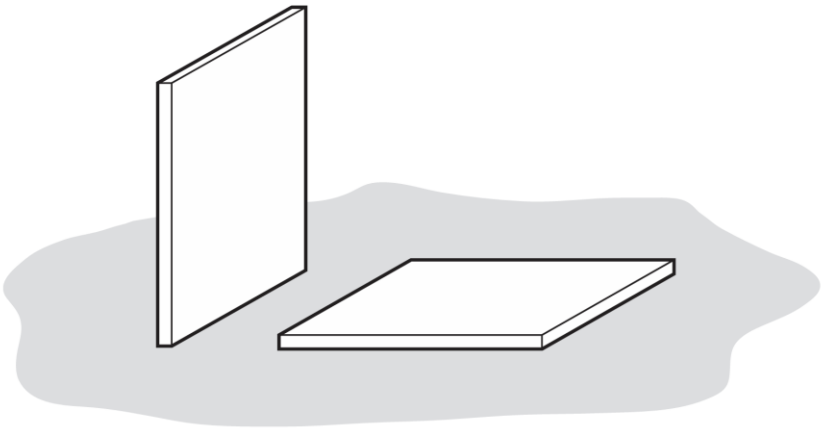
B hang the card from point R

C measure the thickness of the card

D measure the mass of the card

16 A builder leaves two identical, heavy, stone tiles resting on soft earth. One is vertical and the other is horizontal.

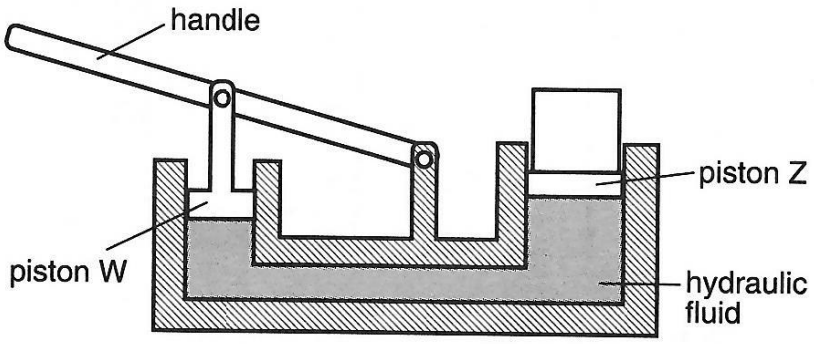
After a few hours, the vertical tile has started to sink into the soft earth. The horizontal one has not started to sink.



Which row correctly compares the forces and the pressures that the tiles exert on the earth?

	forces	pressures
A	different	different
B	different	same
C	same	different
D	same	same

17 The diagram below shows a simple hydraulic jack.

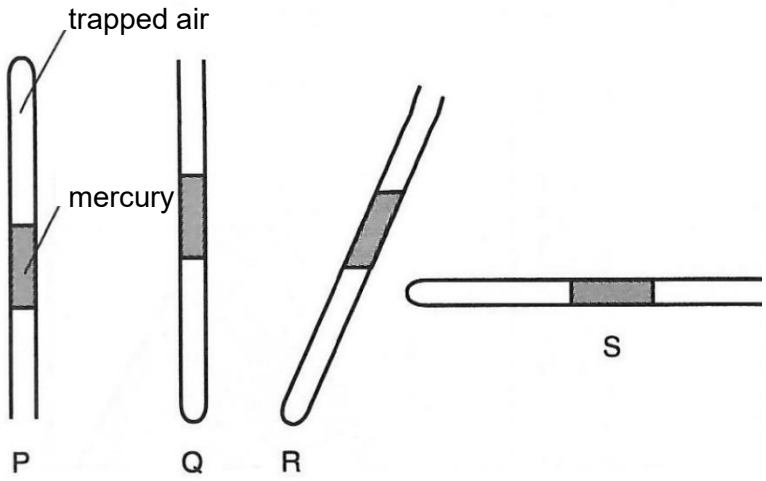


Which changes will enable heavier loads to be lifted?

	diameter of W	diameter of Z
A	doubled	remains the same
B	doubled	doubled
C	remains the same	halved
D	halved	doubled

18 The diagram below shows the same thin tube containing air trapped by a mercury thread, held in four different positions, P, Q, R and S.

The diagrams are not to scale.



Which correctly shows the pressure of trapped air in decreasing order?

A PQRS **B** SPQR

C RSPQ **D** QRSP

19 Which row shows an advantage and a disadvantage of using nuclear fuel to generate electrical power?

	advantage	disadvantage
A	does not produce carbon dioxide	produces radioactive waste
B	does not produce carbon dioxide	only works in some weather conditions
C	energy source is renewable	produces radioactive waste
D	energy source is renewable	only works in some weather conditions

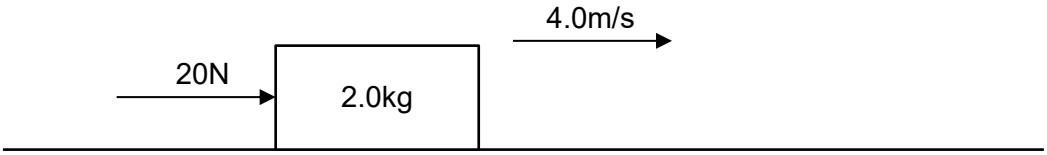
20 A ball is released from a height *h* above a table.

At each bounce, 50% of its energy in the kinetic store is transferred into the internal store of the ball and its surrounding.

Assuming air resistance is negligible, what will be the height reached after the second bounce?

A $\frac{h}{\sqrt{2}}$ **B** $\frac{h}{2}$ **C** $\frac{h}{4}$ **D** $\frac{h}{8}$

21 A force of 20N pushes a block of wood of mass 2.0kg, causing it to move at a constant speed of 4.0m/s.

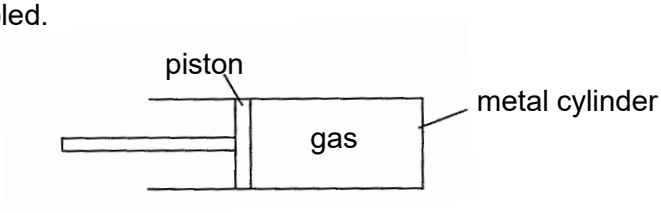


What is the power required to push the wood?

A 5.0W **B** 10W **C** 50W **D** 80W

22 A fixed mass of gas is trapped in a metal cylinder by a moveable piston.

The gas is cooled.



The following shows some properties of the gas molecules:

I the force due to the collisions between the gas molecules and the test-tube walls
II the number of collisions per second by the gas molecules on the test-tube walls
III the average kinetic energy of the gas molecules
IV the average potential energy of the gas molecules

Which property of the gas molecules does **not** decrease?

A I and III only **B** II and IV only
C I, II and IV only **D** none of the above

23 Pure water freezes to ice.

What happens to its particles?

A move closer together and stop moving completely
B move closer together and move at lower speed
C move further apart and vibrate about fixed positions
D move further apart and move at lower speed

24 Air in a closed container contains smoke, illuminated by a beam of bright light.

The smoke particles undergo jerky random motion.

What causes this motion?

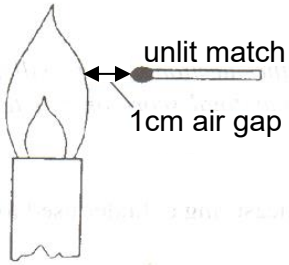
A impact of fast-moving air molecules

B energy from the beam of bright light

C convection current of the air

D collisions between smoke particles

25 An unlit match is held near to an extremely hot Bunsen flame.



Why does the match not get hot enough to light?

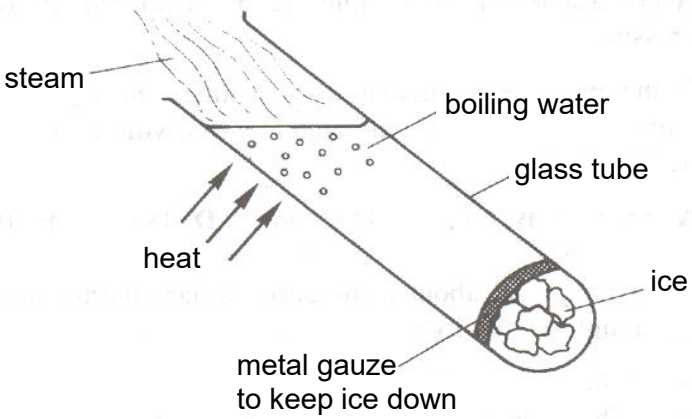
A Air is a bad thermal conductor.

B The match head reflects radiation.

C The flame does not radiate any energy sideways.

D There is insufficient air between the unlit match and the flame for convection.

26 Boiling water and ice can exist at the same time in a test-tube.



What does this experiment show?

A Ice convects heat well.

B Metal gauze conducts heat badly.

C Water conducts heat badly.

D Water convects heat badly.

27 Which type of surface is the best absorber and the best emitter of infra-red radiation?

	best absorber	best emitter
A	black and dull	black and dull
B	black and shiny	white and dull
C	white and dull	black and shiny
D	white and shiny	white and shiny

28 Expanded polystyrene is often used to make containers for storing ice cream.

By which process(es) does the trapped air reduce the energy transfer?

A radiation only

B conduction only

C conduction and convection

D conduction, convection and radiation

29 When equal mass of water and paraffin are heated at the same rate, the temperature of paraffin rises faster.

What causes this?

A Paraffin has a higher boiling point than water.

B Paraffin has a lower boiling point than water.

C Paraffin has a larger specific heat capacity than water.

D Paraffin has a smaller specific heat capacity than water.

30 A substance melts at a temperature of –17°C and boils at a temperature of 117°C.

In which state does the substance exist at –10°C and at 110°C?

	at –10°C	at 110°C
A	solid	liquid
B	solid	gas
C	liquid	liquid
D	liquid	gas

31 Which statement is true when body P is said to be at a higher temperature than Q?

A Body P has a larger heat capacity than body Q.

B Body P has more internal energy than body Q.

C Energy is transferred from body P at a faster rate than body Q.

D Energy is transferred from body P to body Q when they are in contact.

32 A small plastic ball floating on a water surface makes 5.0 oscillations in 10s.

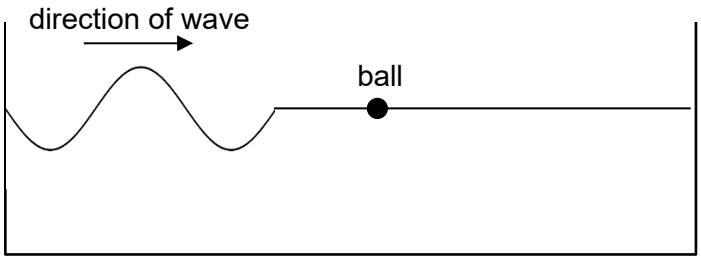
What is the frequency of the water wave?

A 0.20Hz **B** 0.50Hz **C** 2.0Hz **D** 5.0Hz

33 Which row shows the correct examples of transverse and longitudinal waves?

	transverse	longitudinal
A	gamma rays	sound
B	infrared	radio waves
C	light	ultraviolet
D	sound	X-rays

34 The diagram shows a ball floating in a tank of water.



Which diagram shows the movement of the ball when the wave passes?

A

B

C

D

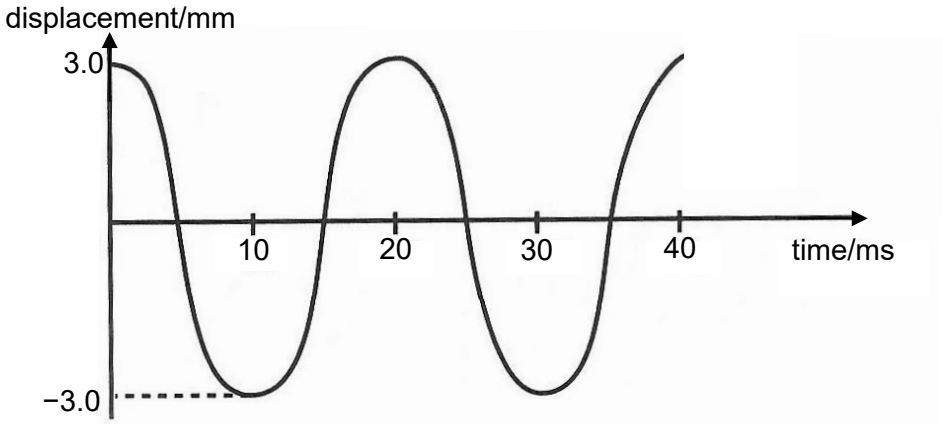
35 A water wave travels from shallow water to deep water in a ripple tank.

What happens to the speed and to the wavelength of the wave?

	speed of wave	wavelength
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

36 A boat oscillates vertically as a water wave passes.

The graph shows how the displacement of the boat from its equilibrium position varies with time.



Which characteristics of the waves can be deduced from this graph?

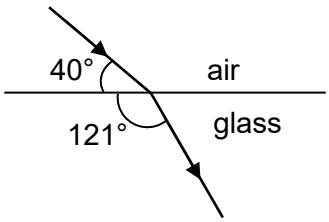
A Its amplitude is 3.0mm and its frequency is 0.050Hz.

B Its amplitude is 3.0mm and its frequency is 50Hz.

C Its wavelength is 20m and its frequency is 0.050Hz.

D Its wavelength is 20m and its frequency is 50Hz.

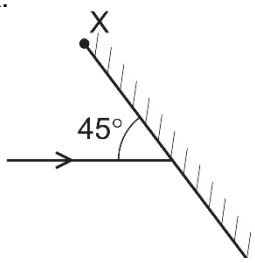
37 The diagram shows a ray of light passing from air into glass.



What is the refractive index of the glass?

A 0.75 **B** 1.2 **C** 1.3 **D** 1.5

38 Light is incident on a mirror at an angle of 45° as shown. The mirror can be rotated about an axis into the page through point X.



The mirror is rotated until the light is reflected back along its original path.

Through which angle is the mirror rotated?

A 22.5° clockwise

B 22.5° anticlockwise

C 45° clockwise

D 45° anticlockwise

39 A converging lens is used to form an image of an object on a screen.

If the top half of the lens is covered with a cardboard, which statement is correct?

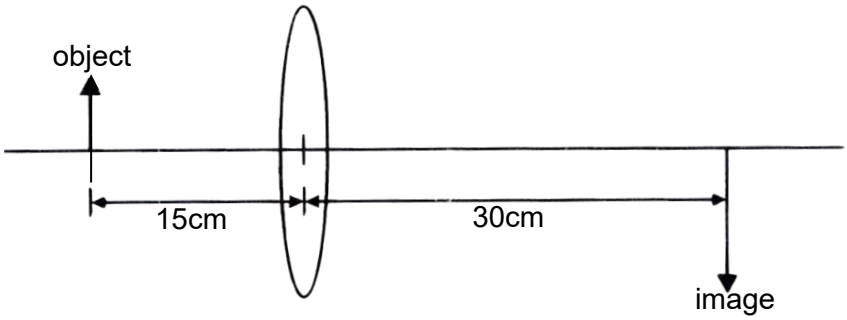
A The bottom half of the image disappears.

B The top half of the image disappears.

C The image is dimmer.

D The image is smaller.

40 When an object is placed 15cm in front of a converging lens, the image is formed 30cm behind the lens.

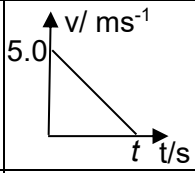
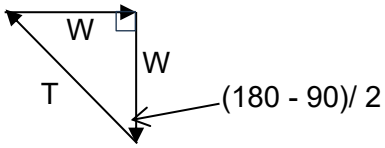


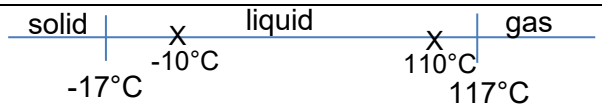
How would the size of the image and the image distance change when the object is moved 5cm away from the lens?

	size of image	image distance
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

END OF PAPER

Answers

1	**C**	Refer to textbook Pg 3.
2	**D**	To "gain" back the time, the period of the pendulum can be increased by using a longer length of pendulum.
3	**B**	A balance to measure the mass and a ruler to measure the length of the metal cube. Density = mass/ volume, where volume = length^3
4	**A**	Increasing deceleration = velocity is decreasing [downward graph] at an increasing rate [increasing gradient].
5	**B**	 Distance travelled = area under graph 3.0 = ½ (5.0) (t) t =1.2s
6	**D**	A ball falling in air will experience decreasing resultant force due to increasing air resistance. ➡ The ball will fall with decreasing acceleration. ➡ Velocity of ball, and hence distance moved by ball per unit time will increase until terminal velocity is reached.
7	**B**	Refer to txtbk Pg 47.
8	**C**	$W = mg$ where gravitational field strength g of moon is smaller than gravitational field strength g of Earth. Weight-mass graph will be a directly proportional graph where the gradient is the gravitational field strength.
9	**B**	Density = mass / volume ρ_A =12/ v while ρ_B =8/ v Hence, $\rho_A : \rho_B$ = 12/8 =1.5
10	**D**	Acceleration is rate of change of velocity. Since F_R = ma, a constant acceleration = constant F_R.
11	**C**	By Newton's 3rd law, • the horse is pulling the box (through the rope) to the left and hence, the box pulls the horse to the right. • The horse's feet pushes to the right (in order to move to the left) while the floor pushes the horse to the left.
12	**C**	The bob is at equilibrium (at rest) = all 3 forces are balanced. In order to form a closed loop triangle for the vector drawing, it must be an isosceles triangle. 
13	**C**	To increase stability, an object must have low centre of gravity and large base area.
14	**D**	Taking moment about pivot, ACW = CW (5.0) (40-20) = W (50-40) W = 10N Hence, mass = 1.0kg
15	**B**	Refer to textbook Pg 85.
16	**C**	Both tiles are identical, hence same weight. Vertical tile has smaller contact area with ground, hence higher pressure.

17	**D**	$F_z = (A_Z/A_W)\ F_w$ Hence, to lift a heavier load F_z, area Z should increase and area W should decrease.
18	**D**	For the pressure of trapped air in P : $P_{trapped\ air} = P_{atmosphere} - P_{mercury\ column}$ Q: $P_{trapped\ air} = P_{atmosphere} + P_{mercury\ column}$ R: $P_{trapped\ air} = P_{atmosphere} + P_{mercury\ column}$, where vertical height of mercury column is smaller S= $P_{trapped\ air} = P_{atmosphere}$ Hence, Q (highest pressure) > R > S > P (lowest pressure)
19	**A**	Refer to textbook Pg130.
20	**C**	After 2 bounces, the energy left in GP store= 50% x (50% of initial Ek) = 0.25 of initial Ek. Initial energy in Ek is transferred from initial GP store, hence the h will be left with 0.25 of initial h.
21	**D**	$P = W / t$ $= (F \times s) / t$ $= F \times (s / t)$ $= F \times v = 20 \times 4.0 = 80W$
22	**D**	When the gas is cooled, the particles will move slower (decrease in internal E_K) and move closer together (decrease in internal E_P), hence colliding with the walls less frequently and less forcefully.
23	**C**	For kinetic model of matter, all particles are in continuous, random motion. During freezing, the average kinetic energy remains constant. Only for water, during freezing, the particles move further apart [open hexagonal structure]
24	**A**	Refer to textbook Pg 140 to 141.
25	**A**	Air is a bad thermal conductor.
26	**C**	Convection currents occur above the heat source and heat travels downward to ice via conduction. Water is a poor thermal conductor.
27	**A**	Black and dull surface are good absorber and emitter of radiation.
28	**C**	Trapped air prevents convection current from occurring and air is a poor thermal conductor.
29	**D**	A smaller specific heat capacity means that a smaller change of internal energy per unit mass is needed to cause a unit change in temperature. Hence, temperature will rise faster for the same amount of energy supplied.
30	**C**	
31	**D**	Option D is correct as energy is transferred (via heating) from a region of higher temperature to a region of lower temperature. Option A and B cannot be determined as the material and mass (number of particles) of substance are not given. Option C cannot be determined as the material, surface area, surface colour and surface texture are not given.
32	**B**	Frequency is the number of oscillations each point completes in one second. Hence, $f = 5.0/10$ $= 0.50Hz$

33	**A**	Sound wave is a longitudinal wave while all electromagnetic waves are transverse waves.
34	**C**	For transverse wave, direction of vibration of particles is perpendicular to travel of wave.
35	**D**	Speed of waves increases in deep water. As $v = f\lambda$ and frequency remains constant, λ increases when v increases.
36	**B**	Amplitude is the maximum displacement from rest position. $f = 1/T = 1/(20\times10^{-3}) = 50$Hz
37	**D**	$n = \sin i / \sin r$ $n = \sin(90-40)/\sin(121-90)$ n = 1.5 (to 2sf)
38	**C**	For light to be reflected back along original path, angle of incidence = 0° Hence, the mirror must rotate 45° clockwise to obtain a vertical mirror.
39	**C**	Less light rays passes through the half-covered lens to form the image.
40	**A**