



PHYSICS
STANDARD LEVEL
PAPER 1

Tuesday 15 May 2001 (afternoon)

45 minutes

INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

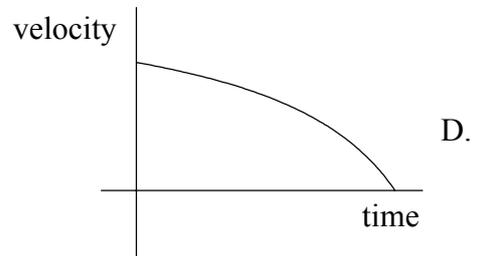
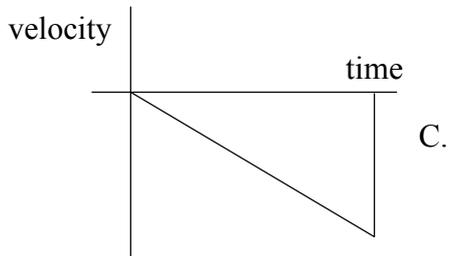
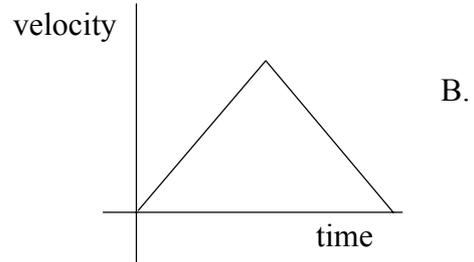
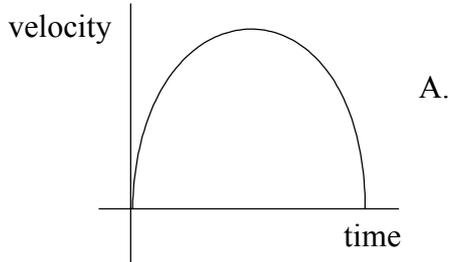
1. The volume V , pressure P , and temperature T , of a fixed number of moles of an ideal gas are related by

$$\frac{PV}{T} = \text{constant}.$$

If the relationship between pressure and volume at constant temperature is investigated experimentally, which one of the following plots would produce a linear graph?

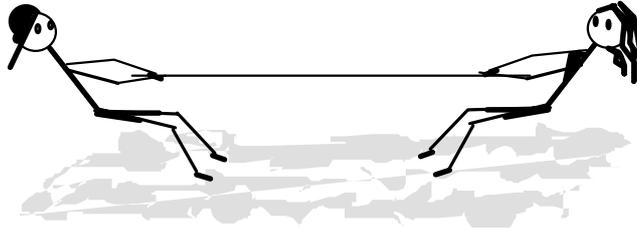
- A. P against V
 - B. $\frac{1}{P}$ against $\frac{1}{V}$
 - C. P against $\frac{1}{V}$
 - D. No plot can produce a straight line
2. The units of gravitational field strength are
- A. N kg^{-1} .
 - B. kg m^{-2} .
 - C. N m s^{-2} .
 - D. N .

3. A projectile is launched **horizontally** from a high tower. Which one of the following graphs best represents the **vertical component** of the projectile's velocity from the time it is launched to the time it hits the ground? Assume negligible air resistance.



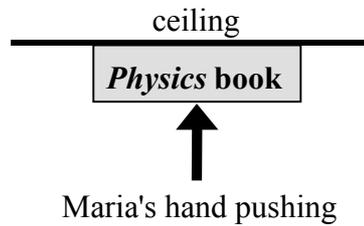
4. An astronaut drops an apple on the surface of the Moon where the acceleration due to gravity is $\frac{1}{6}$ of that on Earth. The time it takes for the apple to fall to the 'ground' compared with an apple dropped from the same height on Earth is
- A. the same.
 - B. $\sqrt{6}$ times as long.
 - C. 6 times as long.
 - D. 36 times as long.

5. Two people are pulling on the ends of a rope. Each person pulls with a force of 100 N.



The tension in the rope is

- A. 0 N.
 - B. 50 N.
 - C. 100 N.
 - D. 200 N.
6. Maria pushes a book up against the horizontal ceiling of her room as shown in the figure. The book weighs 20 N and she pushes upwards with a force of 25 N. The choices below list the magnitudes of the contact forces between the ceiling and the book, and between the book and her hand. Select the correct pair.



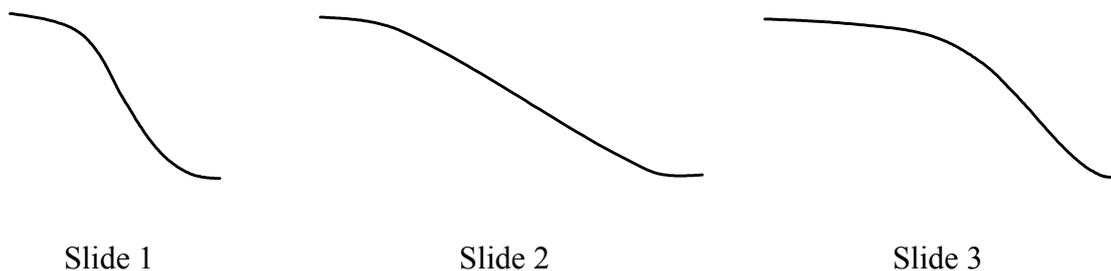
- | | ceiling and the book | book and her hand |
|----|-----------------------------|--------------------------|
| A. | 5 N | 45 N |
| B. | 5 N | 25 N |
| C. | 25 N | 5 N |
| D. | 20 N | 5 N |

7. Liam is pushing a heavy box up a ramp at a constant speed. There is friction between the ramp and the box. The box
- A. is gaining potential energy but losing kinetic energy.
 - B. is gaining potential energy and kinetic energy.
 - C. is only gaining potential energy.
 - D. gains no energy.

8. Anna is riding a bicycle at a certain speed then stops pedalling and slows down to a half of her original speed. If the total kinetic energy of Anna and the bicycle was initially K_0 , after slowing down it is

- A. $\frac{K_0}{8}$.
- B. $\frac{K_0}{4}$.
- C. $\frac{K_0}{2}$.
- D. $\frac{K_0}{\sqrt{2}}$.

9. A child slides down from the top of each of the three slides shown below. All the slides start and finish at the same heights above ground level and all can be taken as frictionless.



Which **one** of the following is correct?

- A. Slide 1 will give the greatest speed at the bottom.
- B. Slide 2 will give the greatest speed at the bottom.
- C. Slide 3 will give the greatest speed at the bottom.
- D. All three slides will give the same speed at the bottom.

10. A projectile strikes a plastic sheet at a speed of 150 m s^{-1} . It penetrates the sheet and emerges with a speed of 50 m s^{-1} . The initial and final momenta of the projectile are represented by the following vectors.



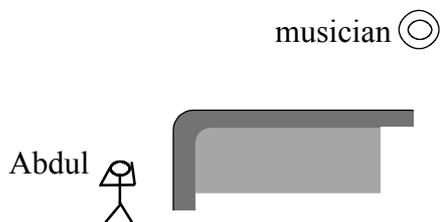
Which **one** of the following vectors best represents the momentum **change** for the projectile?

- A.
- B.
- C.
- D.
11. A particle is undergoing simple harmonic motion. When it is passing through its equilibrium position, which **one** of the following about its acceleration and kinetic energy is correct?

	acceleration	kinetic energy
A.	zero	maximum
B.	zero	zero
C.	maximum	zero
D.	maximum	maximum

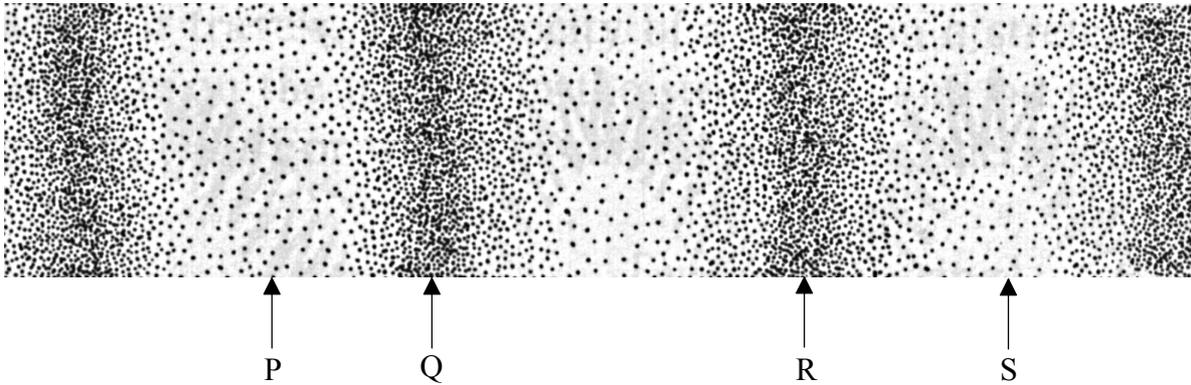
12. A surfer is out beyond the breaking surf in a deep-water region where the ocean waves are sinusoidal in shape. The crests are 20 m apart and the surfer rises a vertical distance of 4.0 m from wave **trough** to **crest**, in a time of 2.0 s. What is the speed of the waves?
- A. 1.0 m s^{-1}
- B. 2.0 m s^{-1}
- C. 5.0 m s^{-1}
- D. 10.0 m s^{-1}

13. A street musician is playing an instrument in a large, open city square. Although Abdul cannot see the musician around the corner, he can still be heard. The main phenomenon that allows Abdul to hear the musician is



- A. the Doppler effect.
 - B. diffraction.
 - C. refraction.
 - D. reflection.
14. Which **one** of the following is **not** an electromagnetic wave?
- A. radio
 - B. microwaves
 - C. ultrasound
 - D. X-rays

15. A pure tone is produced by a tuning fork. The diagram below represents the air particles nearby, at a given instant of time.

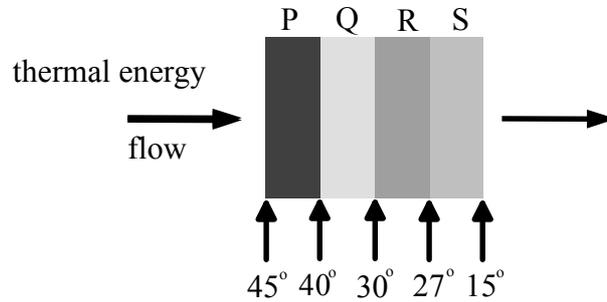


The wavelength of this pure tone is equal to the distance between which of the marked positions?

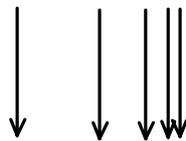
- A. P and Q
 - B. P and S
 - C. Q and S
 - D. Q and R
16. A piano tuner is making use of the phenomenon of beats in order to tune a piano. He sounds a tuning fork which produces a pure tone and at the same time strikes a key on the piano. As he tunes the piano note more closely to the tuning fork note, the beats he hears will become
- A. less frequent.
 - B. more frequent.
 - C. softer.
 - D. louder.

17. If the refractive indices of water and a particular glass are 1.33 and 1.56 respectively, then total internal reflection at an interface between them
- A. can never occur.
 - B. may occur only when the light goes from glass to water.
 - C. may occur only when the light goes from water to glass.
 - D. may occur for light going either from water to glass or from glass to water.
18. Jillian heats up her bath water by adding hot water at 80°C to 9 times that amount of water already in the bath, at 30°C . The best estimate for the final temperature of the water is
- A. 35°C .
 - B. 40°C .
 - C. 45°C .
 - D. 50°C .
19. When two bodies are in contact, the **direction** of thermal energy transfer depends on their
- A. surface areas.
 - B. masses.
 - C. specific heat capacities.
 - D. temperatures.

20. The diagram shows four rectangular slabs of different materials labelled, P, Q, R and S. They have equal thickness and are placed side by side, in contact. Thermal energy flows from left to right and the steady-state temperatures of the interfaces are given. The material with the largest thermal conductivity is



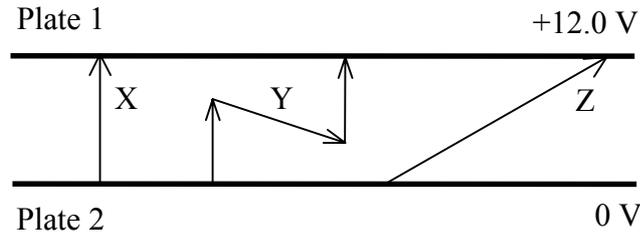
- A. P.
 - B. Q.
 - C. R.
 - D. S.
21. The pressure a gas exerts on a container wall is due to the
- A. change in kinetic energy of the gas molecules as they strike the wall.
 - B. change in momentum of the gas molecules as they strike the wall.
 - C. average potential energy of the gas molecules.
 - D. force of repulsion between the gas molecules.
22. The distribution of electric field lines in a certain region of space varies as shown in the figure.



The magnitude of the electric field in this region

- A. increases to the right.
- B. decreases to the right.
- C. increases in the downward direction.
- D. decreases in the downward direction.

23. A pair of charged, parallel metal plates have voltages as shown in the figure below.



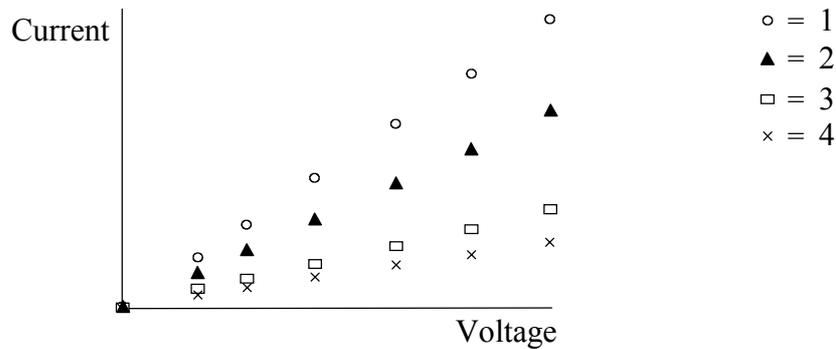
The work required to move a small positive test charge from Plate 2 to Plate 1 is

- A. greatest for path X.
 B. greatest for path Y.
 C. greatest for path Z.
 D. the same for all paths.
24. An electron and a proton travelling with the same velocity are injected into a region of uniform magnetic field at 90° to the magnetic field direction. The **initial** magnetic forces on them are
- A. equal in magnitude and direction.
 B. equal in magnitude and opposite in direction.
 C. equal in magnitude and perpendicular to each other.
 D. in opposite directions and differing in magnitude by the ratio of their masses.
25. A DC electric motor converts 75 % of the input electrical energy to mechanical energy. The remaining 25 % is
- A. dissipated as heat energy.
 B. returned to the battery.
 C. used to maintain the potential difference of the battery.
 D. converted to electrical potential energy.

26. 1 kilowatt hour is the same as

- A. $\frac{1}{3.6}$ J.
- B. 3.6 J.
- C. 1000 J.
- D. 3.6×10^6 J.

27. In a laboratory experiment, a variable voltage power supply is used to provide voltage versus current data for two unequal resistors. These two resistors are first connected separately to the power supply, then as a series combination and then as a parallel combination. The four sets of results are plotted as shown.



Which set of results would correspond to the two resistors connected in parallel?

- A. 1
 - B. 2
 - C. 3
 - D. 4
28. Nuclei with a Z number greater than about 20 and which are stable against radioactive decay have
- A. equal numbers of neutrons and protons.
 - B. more neutrons than protons.
 - C. fewer neutrons than protons.
 - D. no neutrons.

29. What type of single radioactive decay process does **not** change the value of Z , the value of N or the value of A ?
- A. Only beta decay
 - B. Only alpha decay
 - C. Only gamma decay
 - D. Both beta and gamma decay
30. Two radioactive sources X and Y have the same initial activity. X has a half life of 2 hours and Y a half life of 1 hour. What is the ratio of the activities of X to Y after 4 hours?
- A. 2 : 1
 - B. 4 : 1
 - C. 8 : 1
 - D. 16 : 1
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