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PHYSICS
STANDARD LEVEL
PAPER 1

Monday 6 May 2013 (morning)

45 minutes

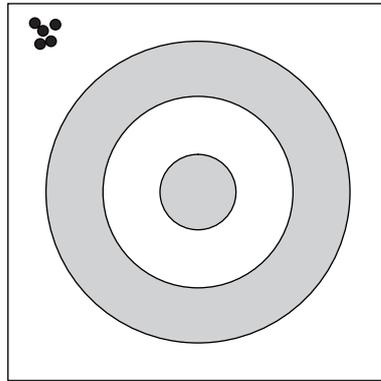
INSTRUCTIONS TO CANDIDATES

- 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.
- A clean copy of the **Physics Data Booklet** is required for this paper.
- The maximum mark for this examination paper is [30 marks].

1. The mass of an elephant is 10^4 kg. The mass of a mouse is 10^{-2} kg. What is the ratio

$$\frac{\text{mass of the elephant}}{\text{mass of the mouse}} ?$$

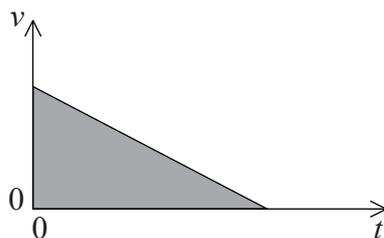
- A. 10^{-8}
- B. 10^{-6}
- C. 10^6
- D. 10^8
2. An archer aims five arrows at the centre of a target. The arrows strike the target as shown below.



Which of the following describes the aim of the archer?

- A. Accurate and precise
- B. Accurate but not precise
- C. Precise but not accurate
- D. Neither accurate nor precise

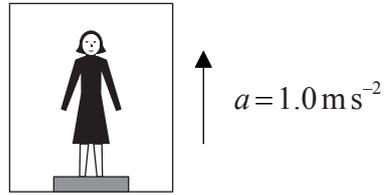
3. The graph below shows how velocity v varies with time t for a ball thrown vertically upwards from the Earth's surface.



The shaded area is equal to the

- A. displacement.
- B. final velocity.
- C. change in velocity.
- D. acceleration.
4. Two identical balls are dropped from a tall building, one a few seconds after the other. Air resistance is **not** negligible. As the balls fall, the distance between the balls will
- A. decrease.
- B. increase.
- C. increase then remain constant.
- D. remain constant.
5. Which of the following is always true for an object moving in a straight line at constant speed?
- A. No forces act on the object.
- B. No resultant force acts on the object.
- C. The momentum of the object is zero.
- D. No work is being done on the object.

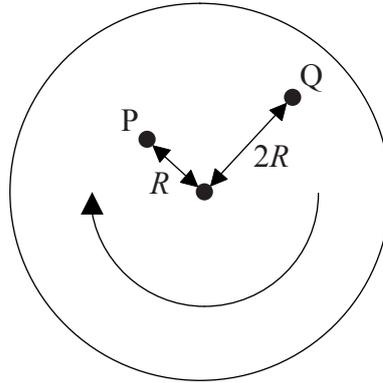
6. A person of weight 600 N is standing on a weighing scale in a lift (elevator). The lift is accelerating upwards at 1.0 m s^{-2} . Which of the following is the reading on the scale?



- A. 0 N
 B. 540 N
 C. 600 N
 D. 660 N
7. A spaceship is moving at constant speed in outer space. An internal explosion causes it to break into two pieces that move in opposite directions. Which of the following best describes what happens to its total momentum and total kinetic energy as a result of the explosion?

	Total momentum	Total kinetic energy
A.	unchanged	unchanged
B.	unchanged	increased
C.	increased	unchanged
D.	increased	increased

8. A horizontal disc is rotating about a vertical axis through its centre. Points P and Q on the disc are at distances R and $2R$ respectively from the centre.



The acceleration at P is a . Which of the following is the acceleration at Q?

- A. $0.5a$
 - B. a
 - C. $2a$
 - D. $4a$
9. 4.0kg of water at 100°C is mixed with 1.0kg of water at 0°C in a container insulated from the surroundings. Which of the following is the final temperature of the water?
- A. 20°C
 - B. 25°C
 - C. 75°C
 - D. 80°C

10. Which of the following best describes the evaporation of a liquid?

	Location of process	Temperature at which process can occur
A.	at surface	at any temperature of liquid
B.	at surface	at maximum liquid temperature only
C.	throughout liquid	at any temperature of liquid
D.	throughout liquid	at maximum liquid temperature only

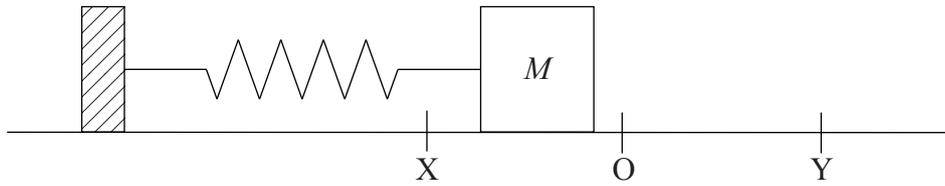
11. Which of the following is the temperature of an object related to?

- A. The kinetic energy of the object
- B. The random kinetic energy of the particles in the object
- C. The potential energy of the particles in the object
- D. The sum of the random kinetic energy and potential energy of the particles in the object

12. The acceleration of an object executing simple harmonic motion is proportional to the

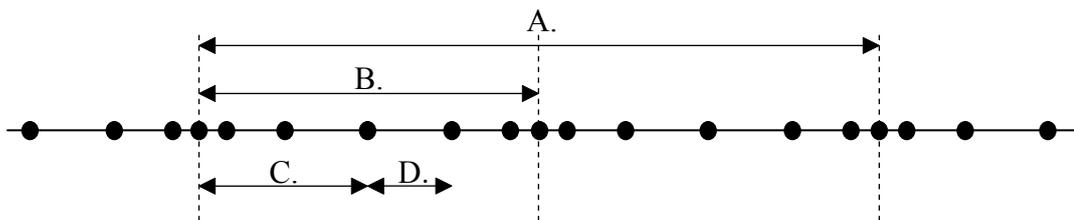
- A. displacement of the object from equilibrium.
- B. velocity of the object.
- C. amplitude of oscillation.
- D. frequency of oscillation.

13. A system, consisting of a mass M connected to a spring, oscillates on a frictionless surface with simple harmonic motion between two points, X and Y. Point O is the centre of the oscillation.



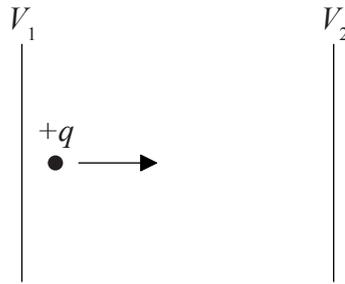
For the system, at which of the following points is the elastic potential energy equal to the kinetic energy?

- A. O only
 - B. X and Y only
 - C. O, X and Y
 - D. Neither O, X nor Y
14. Microwave ovens cause the water molecules in food to resonate. Water molecules have a natural frequency of vibration f . In order to heat the food most effectively, the frequency of the microwaves should have a value
- A. less than f .
 - B. equal to f .
 - C. greater than f .
 - D. as large as possible.
15. Gas particles are equally spaced along a straight line. A sound wave passes through the gas. The positions of the gas particles at one instant are shown below.



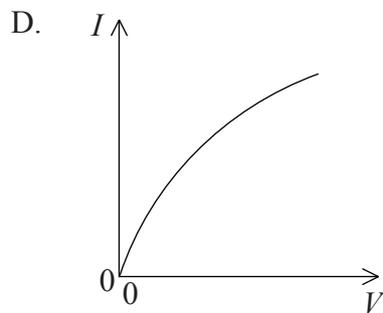
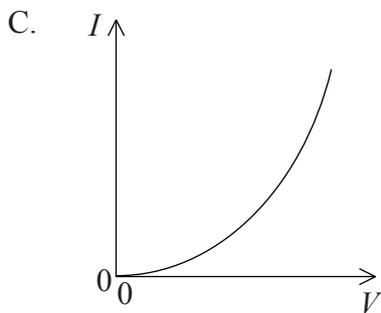
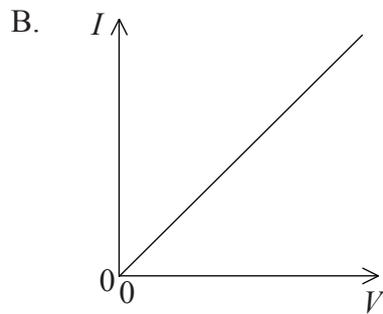
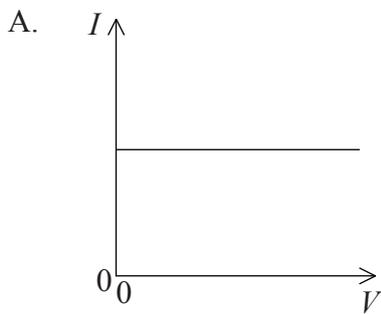
Which of the distances shown is equal to the wavelength of the wave?

16. A particle with positive charge $+q$ moves freely from one plate held at potential V_1 to another plate held at potential V_2 .

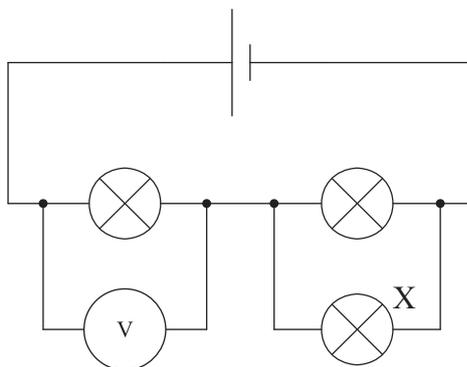


Which of the following is the electric potential energy lost by the charge?

- A. qV_1
 - B. qV_2
 - C. $q(V_1 + V_2)$
 - D. $q(V_1 - V_2)$
17. Which of the following graphs shows the relationship between current I and voltage V for a filament lamp?



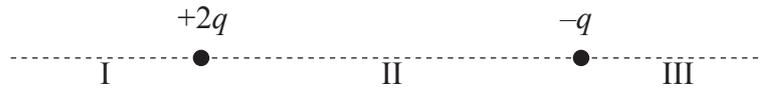
18. A cell of negligible internal resistance is connected to three identical lamps. A voltmeter is connected across one of the lamps.



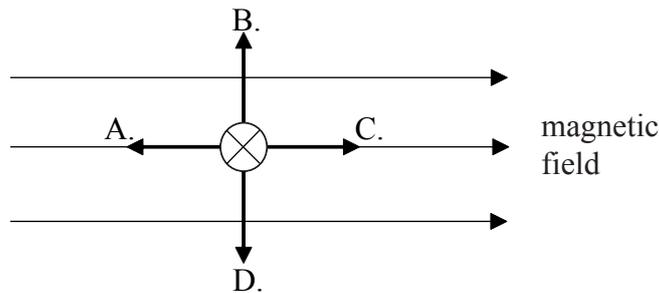
If the filament in lamp X breaks, the reading on the voltmeter will

- A. become zero.
 - B. decrease.
 - C. stay the same.
 - D. increase.
19. The gravitational field strength at the surface of a certain planet is g . Which of the following is the gravitational field strength at the surface of a planet with twice the radius and twice the mass?
- A. $\frac{g}{2}$
 - B. g
 - C. $2g$
 - D. $4g$

20. Two point charges of size $+2q$ and $-q$ are placed as shown below. In which of the regions I, II and III can the resultant electric field strength be zero?

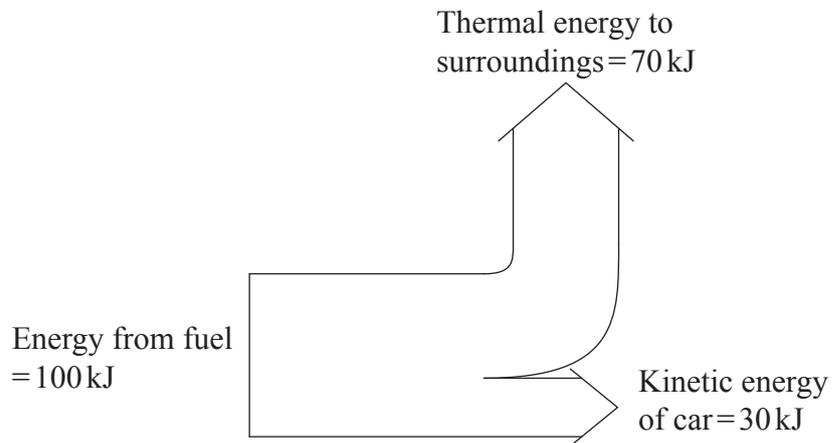


- A. I only
 - B. II only
 - C. III only
 - D. I and III only
21. A wire is placed in a magnetic field which is directed to the right. The wire carries a current directed into the page. Which of the following is the direction of the force on the wire?



22. Which of the following would decrease the initial activity of a sample of plutonium?
- A. Placing the sample in a lead container
 - B. Placing the sample in a dark room
 - C. Decreasing the mass of the sample
 - D. Decreasing the temperature of the sample

23. A radioactive sample of initial activity 12 Bq has a half-life of 3 days. What is the activity after 6 days?
- A. 2 Bq
 - B. 3 Bq
 - C. 4 Bq
 - D. 6 Bq
24. The reaction ${}^{14}_7\text{N} + {}^4_2\alpha \rightarrow {}^{17}_8\text{O} + {}^1_1\text{p}$ is an example of
- A. alpha decay.
 - B. artificial transmutation.
 - C. nuclear fusion.
 - D. proton decay.
25. The diagram below shows an energy flow diagram (Sankey diagram) for a car.



What is the efficiency of the car?

- A. 30%
- B. 40%
- C. 70%
- D. 100%

26. A small biofuel power station burns ethanol with an overall efficiency of 25%. The energy density of ethanol is 30 MJ kg^{-1} . The mass of fuel consumed every second is 50 kg. Which of the following gives the useful power output in MW?
- A. $\frac{30 \times 50 \times 25}{100}$
- B. $\frac{30 \times 50 \times 100}{25}$
- C. $\frac{30 \times 25}{50 \times 100}$
- D. $\frac{30 \times 100}{50 \times 25}$
27. An oscillating water column ocean-wave energy converter produces power P from waves of a certain amplitude and wavespeed. Which of the following would be the power produced from waves of twice the amplitude and twice the wavespeed?
- A. $2P$
- B. $4P$
- C. $8P$
- D. $16P$
28. The total power radiated by the Sun is P . The distance from the Sun to the Earth is d . The albedo of the Earth is α . What is the power absorbed by each square metre of the Earth's surface?
- A. $4\pi d^2 P \alpha$
- B. $\frac{P \alpha}{4\pi d^2}$
- C. $4\pi d^2 P (1 - \alpha)$
- D. $\frac{P(1 - \alpha)}{4\pi d^2}$

- 29.** Carbon dioxide is a greenhouse gas because
- A. it absorbs infrared light radiated by the Sun.
 - B. it absorbs ultraviolet light radiated by the Earth.
 - C. its natural frequency molecular oscillation lies in the infrared region.
 - D. its natural frequency molecular oscillation lies in the ultraviolet region.
- 30.** Which of the following is most likely to increase the rate of global warming?
- A. Deforestation
 - B. Increasing the use of nuclear power stations
 - C. Increasing the use of renewable energy sources
 - D. Using natural gas instead of coal for electricity generation
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