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**PHYSICS
STANDARD LEVEL
PAPER 1**

Wednesday 11 May 2011 (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. Which of the following contains one fundamental and one derived unit?

A.	ampere	kilogram
B.	ampere	coulomb
C.	joule	newton
D.	joule	coulomb

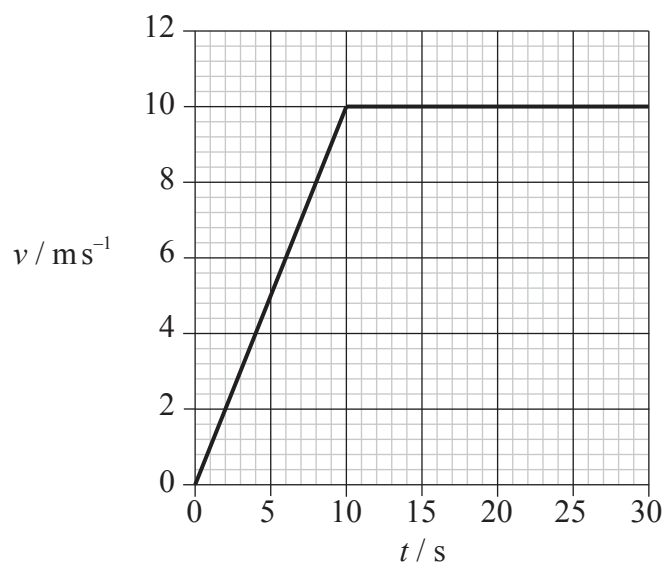
2. The current I through a resistor is measured with a digital ammeter to be 0.10 A. The uncertainty in the calculated value of I^2 will be

- A. 1%.
- B. 2%.
- C. 5%.
- D. 20%.

3. A skydiver of mass 80 kg falls vertically with a constant speed of 50 ms^{-1} . The upward force acting on the skydiver is approximately

- A. 0 N.
- B. 80 N.
- C. 800 N.
- D. 4000 N.

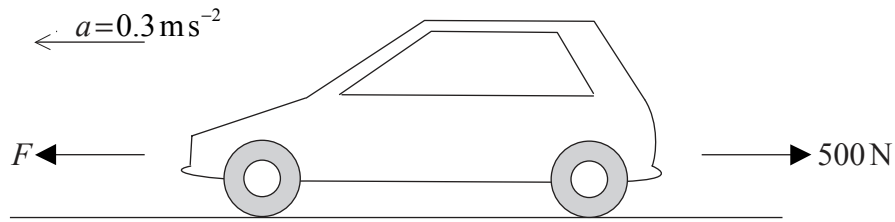
4. Joseph runs along a long straight track. The variation of his speed v with time t is shown below.



After 25 seconds Joseph has run 200 m. Which of the following is correct at 25 seconds?

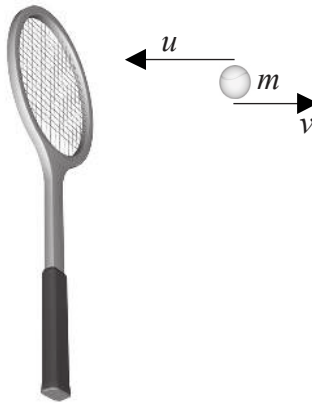
	Instantaneous speed / m s^{-1}	Average speed / m s^{-1}
A.	8 m s^{-1}	8 m s^{-1}
B.	8 m s^{-1}	10 m s^{-1}
C.	10 m s^{-1}	8 m s^{-1}
D.	10 m s^{-1}	10 m s^{-1}

5. A car of mass 1000 kg accelerates on a straight, flat, horizontal road with an acceleration $a=0.3 \text{ ms}^{-2}$. The driving force F on the car is opposed by a resistive force of 500 N.



The net (resultant) force on the car is

- A. 200 N.
 - B. 300 N.
 - C. 500 N.
 - D. 800 N.
6. A tennis ball of mass m moving horizontally with speed u strikes a vertical tennis racket. The ball bounces back with a horizontal speed v .



The magnitude of the change in momentum of the ball is

- A. $m(u + v)$.
- B. $m(u - v)$.
- C. $m(v - u)$.
- D. zero.

7. A brother and sister take the same time to run up a set of steps. The sister has a greater mass than her brother. Which of the following is correct?

	Has done the most work	Has developed the greatest power
A.	brother	brother
B.	brother	sister
C.	sister	brother
D.	sister	sister

8. A nuclear power station produces 10 GW of electrical power. The power generated by the nuclear reactions in the core of the reactor is 25 GW. The efficiency of the power station is

- A. 15%.
- B. 35%.
- C. 40%.
- D. 60%.

9. A cyclist rides around a circular track at a uniform speed. Which of the following correctly gives the net horizontal force on the cyclist at any given instant of time?

	Net horizontal force along direction of motion	Net horizontal force normal to direction of motion
A.	zero	zero
B.	zero	non zero
C.	non zero	zero
D.	non zero	non zero

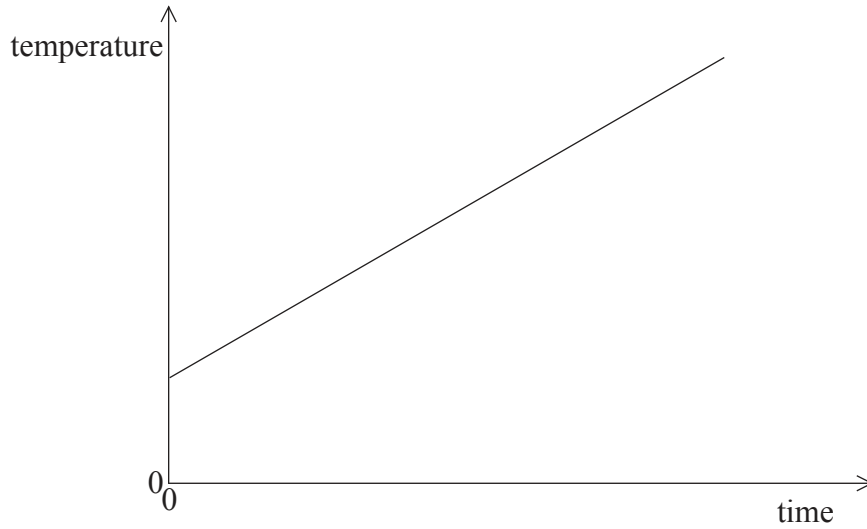
10. A solid piece of tungsten melts into liquid without a change in temperature. Which of the following is correct for the molecules in the liquid phase compared with the molecules in the solid phase?

	Kinetic energy	Potential energy
A.	same	greater
B.	same	same
C.	greater	greater
D.	greater	same

11. What is the mass of carbon-12 that contains the same number of atoms as 14 g of silicon-28?

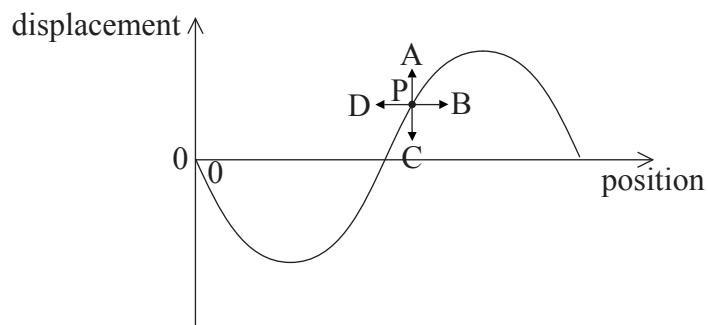
- A. 6 g
- B. 12 g
- C. 14 g
- D. 24 g

12. A heater of constant power heats a liquid of mass m and specific heat capacity c . The graph below shows how the temperature of the liquid varies with time.

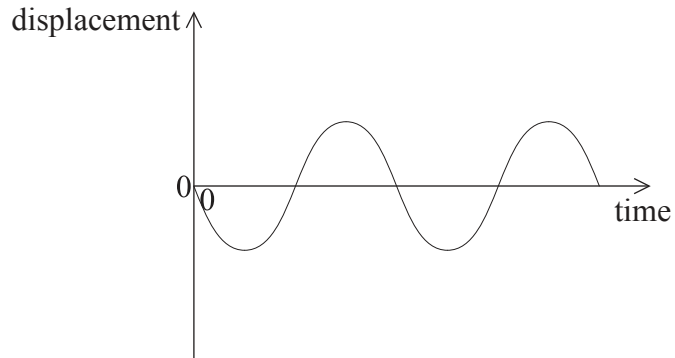


The gradient of the graph is k and no energy is lost to the surroundings. What is the power of the heater?

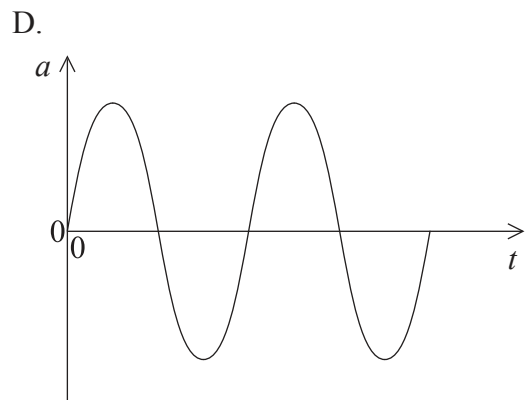
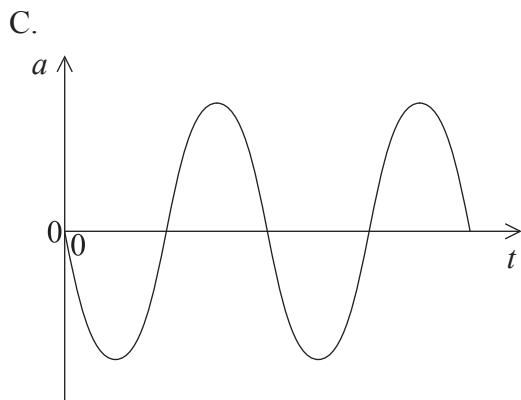
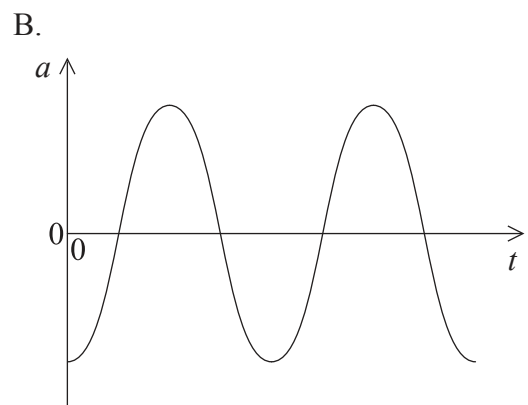
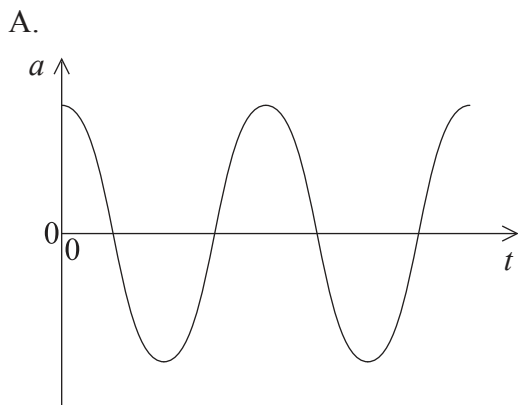
- A. kmc
 - B. $\frac{k}{mc}$
 - C. $\frac{mc}{k}$
 - D. $\frac{1}{kmc}$
13. A transverse wave travels from left to right. The diagram below shows how, at a particular instant of time, the displacement of particles in the medium varies with position. Which arrow represents the direction of the velocity of the particle marked P?



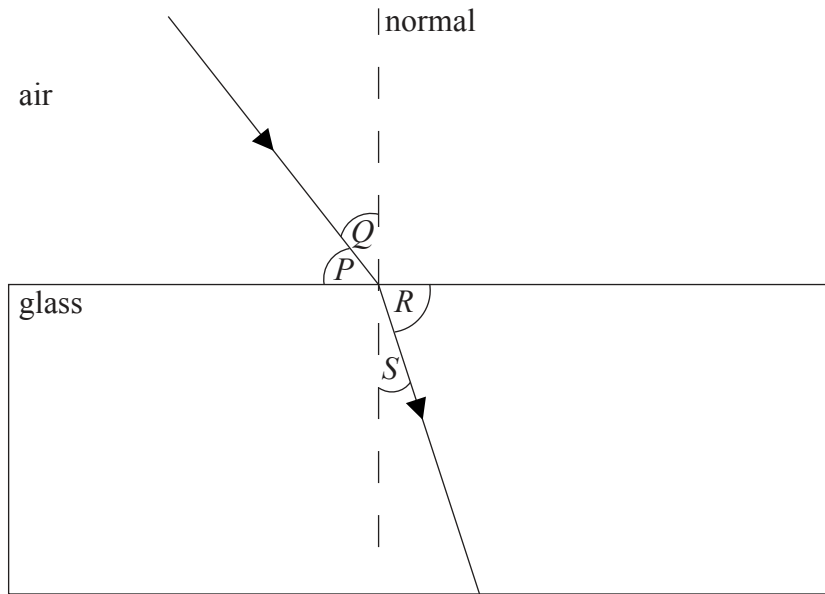
14. The graph shows how the displacement varies with time for an object undergoing simple harmonic motion.



Which graph shows how the object's acceleration a varies with time t ?



15. Light travels from air into glass as shown below.



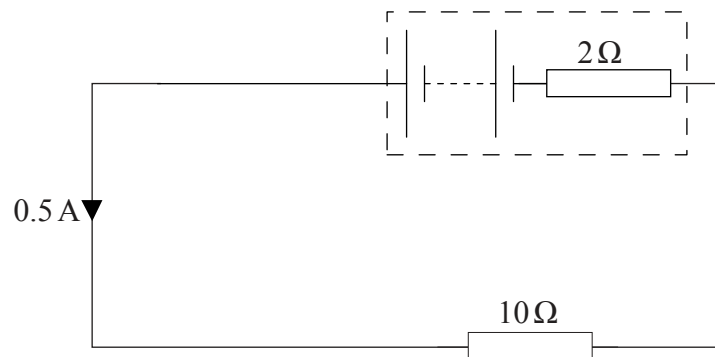
What is the refractive index of glass?

- A. $\frac{\sin P}{\sin S}$
 - B. $\frac{\sin Q}{\sin R}$
 - C. $\frac{\sin P}{\sin R}$
 - D. $\frac{\sin Q}{\sin S}$
16. Which of the following electromagnetic waves has a frequency **greater** than that of visible light?
- A. Ultraviolet
 - B. Radio
 - C. Microwaves
 - D. Infrared

17. One electronvolt is equal to

- A. $1.6 \times 10^{-19} \text{ C}$.
- B. $1.6 \times 10^{-19} \text{ J}$.
- C. $1.6 \times 10^{-19} \text{ V}$.
- D. $1.6 \times 10^{-19} \text{ W}$.

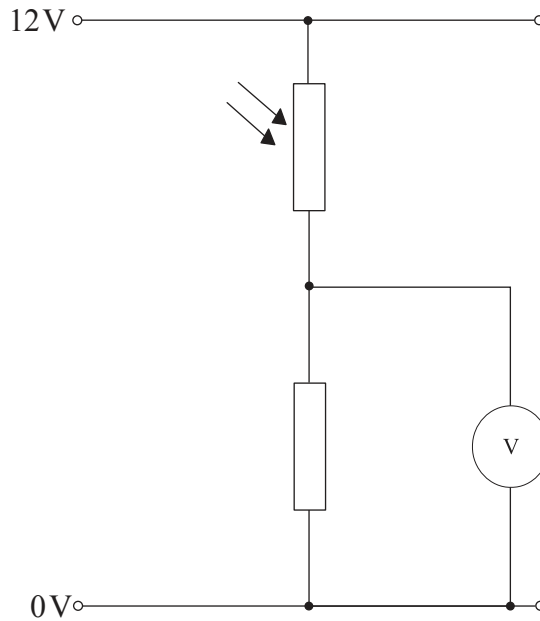
18. A battery of internal resistance 2Ω is connected to an external resistance of 10Ω . The current is 0.5 A .



What is the emf of the battery?

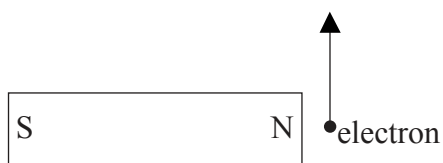
- A. 1.0 V
- B. 5.0 V
- C. 6.0 V
- D. 24.0 V

19. In the circuit below, which of the following will cause the greatest increase in the reading of the voltmeter?



- A. An increase in temperature
 - B. An increase in light intensity
 - C. A decrease in temperature
 - D. A decrease in light intensity
20. A spherical planet of uniform density has three times the mass of the Earth and twice the average radius. The magnitude of the gravitational field strength at the surface of the Earth is g . What is the gravitational field strength at the surface of the planet?
- A. $6g$
 - B. $\frac{2}{3}g$
 - C. $\frac{3}{4}g$
 - D. $\frac{3}{2}g$

21. An electron passes the north pole of a bar magnet as shown below.



What is the direction of the magnetic force on the electron?

- A. Into the page
 - B. Out of the page
 - C. To the left
 - D. To the right
22. Which of the following gives the correct number of protons and neutrons in a nucleus of carbon-14 ($^{14}_6\text{C}$).

	Protons	Neutrons
A.	8	6
B.	6	8
C.	14	6
D.	6	14

23. A freshly prepared sample contains $4.0\mu\text{g}$ of iodine-131. After 24 days, $0.5\mu\text{g}$ of iodine-131 remain. The best estimate of the half-life of iodine-131 is
- A. 8 days.
 - B. 12 days.
 - C. 24 days.
 - D. 72 days.

24. Which of the following causes the greatest number of ionizations as it passes through 1 cm of air? (The total energy of the ionizing radiation is the same.)
- A. An alpha particle
 - B. A beta particle
 - C. A gamma-ray
 - D. An X-ray
25. What is the phenomenon that best explains why greenhouse gases absorb infrared radiation?
- A. Resonance
 - B. Interference
 - C. Refraction
 - D. Diffraction
26. In which of the following places will the albedo be greatest?
- A. A forest
 - B. A grassland
 - C. An ocean
 - D. A polar ice cap

27. A wind turbine produces a power P when the wind speed is v . Assuming that the efficiency of the turbine is constant, the best estimate for the power produced when the wind speed becomes $2v$ is
- A. $2P$.
 - B. $4P$.
 - C. $6P$.
 - D. $8P$.
28. A spherical black body has absolute temperature T_1 . The surroundings are kept at a lower absolute temperature T_2 . What is the net power per unit area lost by the body?
- A. σT_1^4
 - B. σT_2^4
 - C. $\sigma(T_1^4 - T_2^4)$
 - D. $\sigma(T_1^4 + T_2^4)$
29. The design of a nuclear power station includes an electrical generator. The function of the generator is to convert
- A. nuclear energy to kinetic energy.
 - B. kinetic energy to thermal energy.
 - C. thermal energy to electrical energy.
 - D. kinetic energy to electrical energy.
30. What is the unit of surface heat capacity?
- A. $\text{J kg}^{-1}\text{K}^{-1}$
 - B. JK^{-1}
 - C. $\text{J m}^{-2}\text{K}^{-1}$
 - D. $\text{J m}^{-3}\text{K}^{-1}$
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