SAT Physics Practice Papers 12

SET 1

1. Which of the following best approximates the energy of a photon whose wavelength is 2.0 nm? (Planck's constant, *h*, has a value of 6.6×10^{-34} J • s.)

A. 4×10^{-51} J

B. 1×10^{-34} J

C. 1×10^{-16} J

D. 1×10^{34} J

E. 2×10^{-50} J

2. A metal whose work function is 6.0 eV is struck with light of frequency 7.2×10^{15} Hz. What is the maximum kinetic energy of photoelectrons ejected from the metal's surface?

A. 7 eV

B. 13 eV

C. 19 eV

D. 24 eV

E. No photoelectrons will be produced.

3. An atom with one electron has an ionization energy of 25 eV. How much energy will be released when the electron makes the transition from an excited energy level, where $E = -16$ eV, to the ground state?

A. 9 eV

B. 11 eV

C. 16 eV

D. 25 eV

E. 41 eV

4. The single electron in an atom has an energy of –40 eV when it's in the ground state, and the first excited state for the electron is at –10 eV. What will happen to this electron if the atom is struck by a stream of photons, each of energy 15 eV?

A. The electron will absorb the energy of one photon and become excited halfway to the first excited state, then quickly return to the ground state, without emitting a photon.

B. The electron will absorb the energy of one photon and become excited halfway to the first excited state, then quickly return to the ground state, emitting a 15 eV photon in the process.

C. The electron will absorb the energy of one photon and become excited halfway to the first excited state, then quickly absorb the energy of another photon to reach the first excited state.

D. The electron will absorb two photons and be excited to the first excited state.

E. Nothing will happen.

5. What is the de Broglie wavelength of a proton whose linear momentum has a magnitude of 3.3×10^{-23} kg • m/s ?

A. 0.0002 nm

B. 0.002 nm

C. 0.02 nm

D. 0.2 nm

E. 2 nm

6. Compared to the parent nucleus, the daughter of a β^- decay has

A. the same mass number but a greater atomic number

B. the same mass number but a smaller atomic number

C. a smaller mass number but the same atomic number

D. a greater mass number but the same atomic number

E. None of the above

7. The reaction $^{218}_{85}\mathrm{At} \rightarrow {}^{214}_{83}\mathrm{Bi}$ is an example of what type of radioactive decay?

A. alpha

B. β^-

C. β^+

D. electron capture

E. gamma

8. Tungsten-176 has a half-life of 2.5 hours. After how many hours will the disintegration rate of a tungsten-176 sample drop to $\frac{1}{10}$ its initial value?

A. 5

B. 8.3

C. 10

D. 12.5

E. 25

9. What's the missing particle in the following nuclear reaction?

$${}^{2}_{1}\mathrm{H} + {}^{63}_{29}\mathrm{Cu} \rightarrow {}^{64}_{30}\mathrm{Zn} + (?)$$

A. Proton

B. Neutron

C. Electron

D. Positron

E. Deuteron

10. What's the missing particle in the following nuclear reaction?

$${}^{196}_{78}\mathrm{Pt} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{197}_{78}\mathrm{Pt} + (?)$$

A. Proton

B. Neutron

C. Electron

D. Positron

E. Gamma

11. Two spaceships are traveling directly toward each other, one traveling at a speed of $\frac{c}{6}$ and the other at a speed of $\frac{c}{3}$, as measured by observers on a nearby planet. The faster ship emits a radar pulse directed toward the approaching ship. What is the speed of this radar pulse, as measured by observers on the planet?

A. $\frac{c}{2}$

B. $\frac{5c}{6}$

C. c

D. $\frac{7c}{6}$

E. $\frac{3c}{2}$

12. An Imperial battle cruiser, sitting in a hanger deck, is measured to have a length of 200 m by a worker on the deck. If the cruiser travels at a speed of $\left(\frac{\sqrt{3}}{2}\right)c$ past a planet, what will be the length of the cruiser, as measured by the inhabitants of the planet?

A. 0

B. Between 0 and 200 m

C. 200 m

D. Greater than 200 m

E. None of the above, since it is impossible to reach the described speed

13. An astronaut lives on a spaceship that is moving at a speed of $\left(\frac{4}{5}\right)c$ away from the earth. As measured by a clock on the spaceship, the time interval between her maintenance checks on the ship's main computer is 15 months. In the reference frame of the team here on Earth that monitors the ship's progress, what is the time interval between maintenance checks on the ship's main computer?

A. Always less than 15 months

B. Always exactly 15 months

C. Always more than 15 months

D. Initially less than 15 months, but after time more than 15 months

E. Initially more than 15 months, but after time less than 15 months

14. A particle whose rest energy is *E* is traveling at a speed of $\frac{12}{13}c$. What is the particle's kinetic energy?

A. $\frac{7}{169}E$

B. $\frac{5}{13}E$

C. $\frac{3}{5}E$

D. $\frac{8}{5}E$

E. $\frac{13}{5}E$

15. Redshift of distant galaxies is evidence for which of the following?

A. Expansion of the universe

B. The Uncertainty Principle

C. Black holes

D. Dark matter

E. Superconductivity

16. Which of the following is NOT a correct pairing of physicist and field in which he made significant contributions?

A. Newton — gravitation

B. Einstein — relativity

C. Faraday — electricity and magnetism

D. Coulomb — quantum mechanics

E. Bohr — atomic structure

17. The impossibility of making simultaneous, arbitrarily precise measurements of the momentum and the position of an electron is accounted for in

A. thermodynamics

B. quantum mechanics

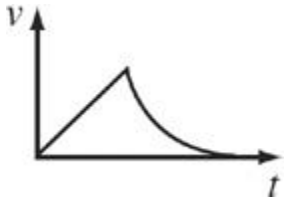
C. classical electrodynamics

D. special relativity

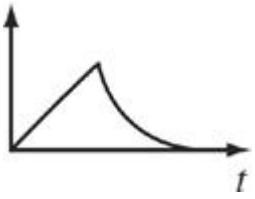
E. general relativity

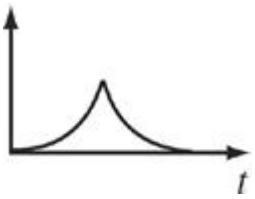
SET 2

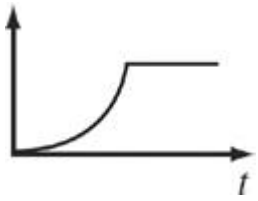
1. For an object traveling in a straight line, its velocity (*v*, in m/s) as a function of time (*t*, in s) is given by the following graph.

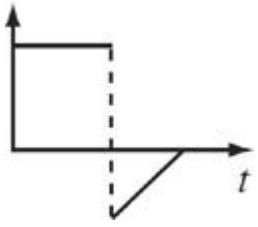


Which graph best depicts the object's momentum?

A.


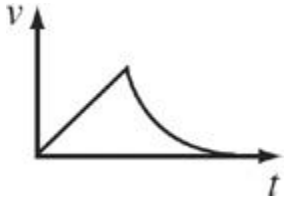
B.


C.


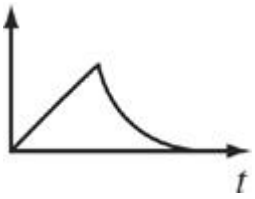
D.


E. 

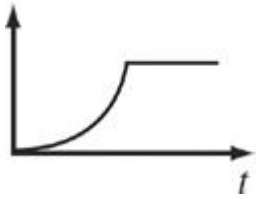
2. For an object traveling in a straight line, its velocity (*v*, in m/s) as a function of time (*t*, in s) is given by the following graph.

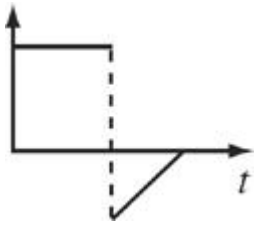


Which graph best illustrates the object's acceleration?

A. 

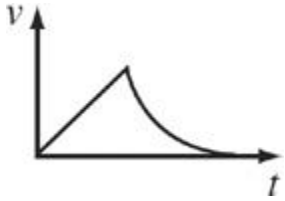
B. 

C. 

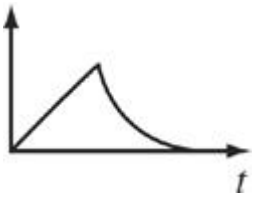
D. 

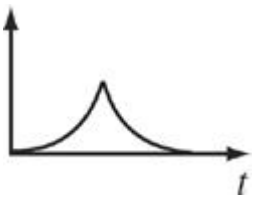
E. 

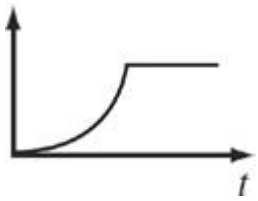
3. For an object traveling in a straight line, its velocity (*v*, in m/s) as a function of time (*t*, in s) is given by the following graph.

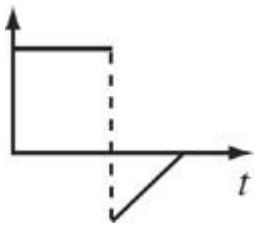


Which graph best depicts the object's kinetic energy?

A. 

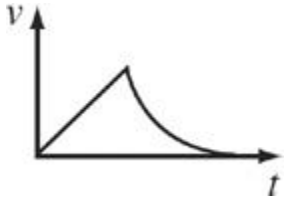
B. 

C. 

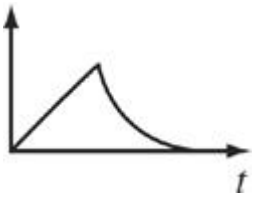
D. 

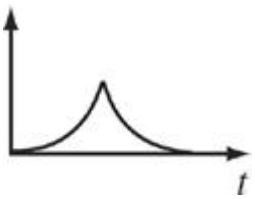
E. 

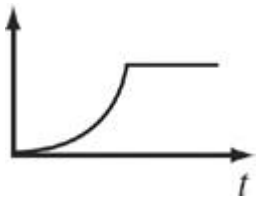
4. For an object traveling in a straight line, its velocity (*v*, in m/s) as a function of time (*t*, in s) is given by the following graph.

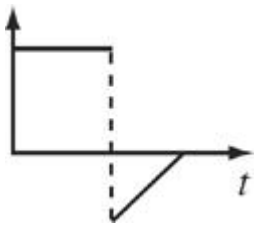


Which graph best illustrates the object's distance from its starting point?

A. 

B. 

C. 

D. 

E. 

5. Which one is NOT a vector?

A. Displacement

B. Velocity

C. Acceleration

D. Linear momentum

E. Kinetic energy

6. If an object's mass and the net force it feels are both known, then Newton's second law could be used to directly calculate which quantity?

A. Displacement

B. Velocity

C. Acceleration

D. Linear momentum

E. Kinetic energy

7. Which quantity can be expressed in the same units as impulse?

A. Displacement

B. Velocity

C. Acceleration

D. Linear momentum

E. Kinetic energy

8. If an object's speed is changing, which of the quantities could remain constant?

A. Displacement

B. Velocity

C. Acceleration

D. Linear momentum

E. Kinetic energy

9. Which provides the basis for the observation that the universe is expanding?

A. Newton's law of universal gravitation

B. Red shift of light from other galaxies

C. The fact that every element of atomic number greater than 83 is radioactive

D. The zeroth law of thermodynamics

E. Mass–energy equivalence

10. Which principle could be used to help calculate the amount of radiation emitted by a star?

A. Newton's law of universal gravitation

B. Red shift of light from other galaxies

C. The fact that every element of atomic number greater than 83 is radioactive

D. The zeroth law of thermodynamics

E. Mass–energy equivalence

11. Which is due to the change in wave speed when a wave strikes the boundary to another medium?

A. Reflection

B. Refraction

C. Polarization

D. Diffraction

E. Interference

12. Which phenomenon is NOT experienced by sound waves?

A. Reflection

B. Refraction

C. Polarization

D. Diffraction

E. Interference

13. An astronaut standing on the surface of the moon (mass = M, radius = R) holds a feather (mass = m) in one hand and a hammer (mass = $100m$) in the other hand, both at the same height above the surface. If he releases them simultaneously, what is the acceleration of the hammer?

A. $\frac{mv^2}{r}$

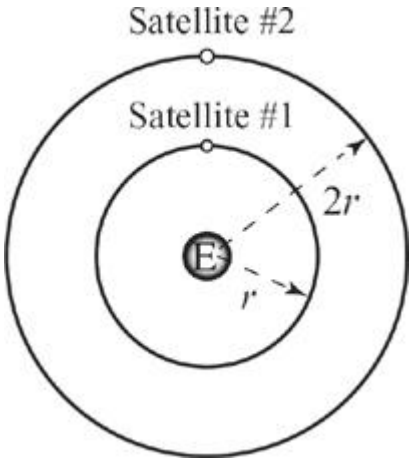
B. $\frac{GM}{R^2}$

C. $\frac{GMm}{R^2}$

D. $100\frac{GM}{R^2}$

E. $100\frac{GMm}{R^2}$

14.



Two satellites orbit the earth. Their orbits are circular, and each satellite travels at a constant speed. If the mass of Satellite #2 is twice the mass of Satellite #1, which satellite's speed is greater?

A. Satellite #1, by a factor of $\sqrt{2}$

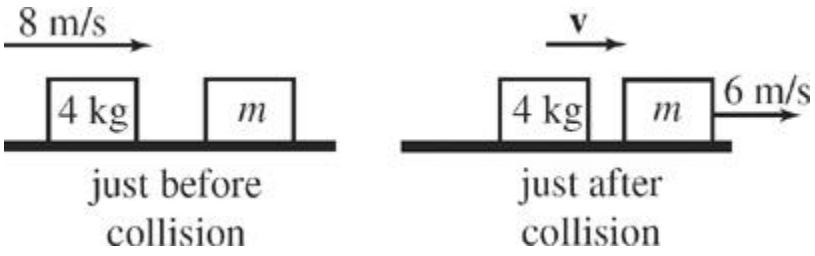
B. Satellite #1, by a factor of 2

C. Satellite #2, by a factor of $\sqrt{2}$

D. Satellite #2, by a factor of 2

E. Neither; the satellites' speeds are the same.

15. It refers to the collision of two blocks on a frictionless table. Before the collision, the block of mass *m* is at rest.



What is the total momentum of the blocks just AFTER the collision?

A. 12 kg-m/s

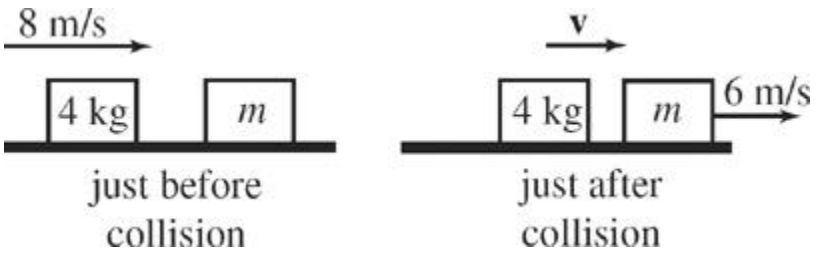
B. 16 kg-m/s

C. 18 kg-m/s

D. 24 kg-m/s

E. 32 kg-m/s

16. It refers to the collision of two blocks on a frictionless table. Before the collision, the block of mass *m* is at rest.



If the collision were elastic, what is the total kinetic energy of the blocks just AFTER the collision?

A. 16 J

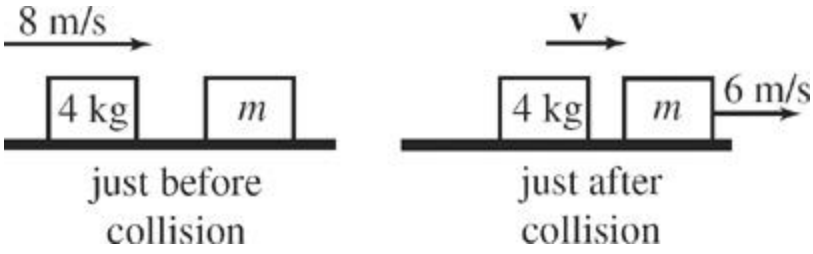
B. 32 J

C. 64 J

D. 128 J

E. 256 J

17. It refers to the collision of two blocks on a frictionless table. Before the collision, the block of mass *m* is at rest.



If the blocks had instead stuck together after the collision, with what speed would they move if m = 12 kg ?

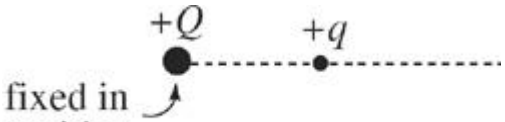
A. 2.0 m/s

B. 2.7 m/s

C. 3.2 m/s

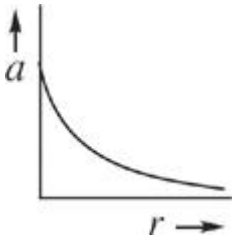
D. 4.0 m/s

E. 4.6 m/s

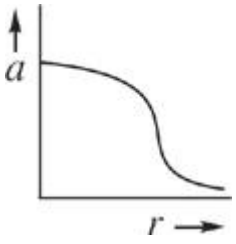


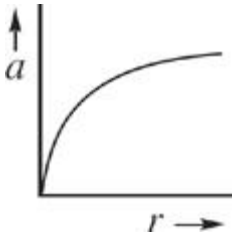
18. The figure above shows two positively charged particles. The +Q charge is fixed in position, and the +q charge is brought close to +Q and released from rest. Which of the following graphs best depicts the acceleration (a) of the +q charge as a function of its distance (r) from +Q ?

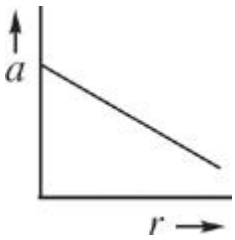
A.

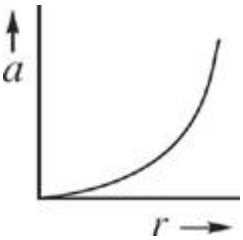


B.



C. 

D. 

E. 

19. Two particles have unequal charges; one is +*q* and the other is –2*q*. The strength of the electrostatic force between these two stationary particles is equal to *F*. What happens to *F* if the distance between the particles is halved?

A. It decreases by a factor of 4.

B. It decreases by a factor of 2.

C. It remains the same.

D. It increases by a factor of 2.

E. It increases by a factor of 4.

20. A simple harmonic oscillator has a frequency of 2.5 Hz and an amplitude of 0.05 m. What is the period of the oscillations?

A. 0.4 sec

B. 0.2 sec

C. 8 sec

D. 20 sec

E. 50 sec