Unit 1 – Our Dynamic Universe
Section 6 - The Expanding Universe

2012 Revised 7. A galaxy is moving away from the Earth at a velocity of $1{\cdot}20 \times 10^7\ \text{m s}^{-1}$.

Light of wavelength 450 nm is emitted from this galaxy.

When detected and measured on Earth this light has a wavelength of

A 425 nm

B 432 nm

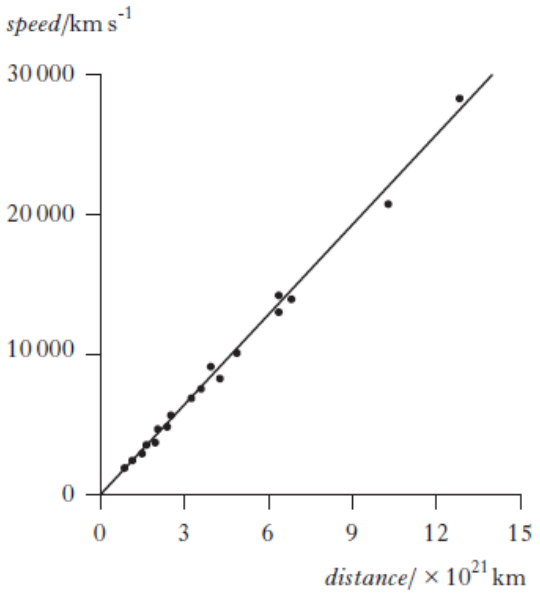
C 468 nm

D 475 nm

E 630 nm.

2012 Revised 8. Galaxies at different distances from the Earth have been found to have different speeds.

The graph shows data for some distant galaxies.



A student studies this graph and makes the following statements.

I The speed of distant galaxies varies inversely with their distance from the Earth.

II The gradient of the line gives the value of Hubble's constant.

III The unit for Hubble's constant is s^{-1}.

Which of these statements is/are correct?

A I only

B II only

C III only

D I and II only

E II and III only

2013 Revised 8. An astronomer observes the spectrum of light from a star. The spectrum contains the emission lines for hydrogen.

The astronomer compares this spectrum with the spectrum from a hydrogen lamp. The line which has a wavelength of 656 nm from the lamp is found to be shifted to 663 nm in the spectrum from the star.

The redshift of the light from this star is

A 0·011

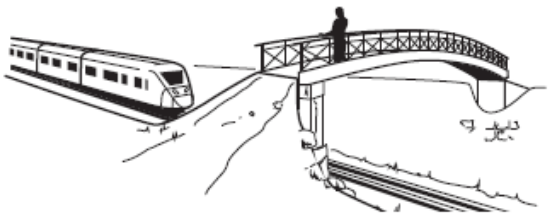
B 0·50

C 0·99

D 2·0

E 94.

2013 Revised 9. A train is travelling at a constant speed of $16{\cdot}0\ \text{m s}^{-1}$ as it approaches a bridge.



A horn on the train emits sound of frequency 277 Hz.

The sound is heard by a person standing on the bridge.

The speed of sound in air is $340\ \text{m s}^{-1}$.

The frequency of the sound heard by the person on the bridge is

A 265 Hz

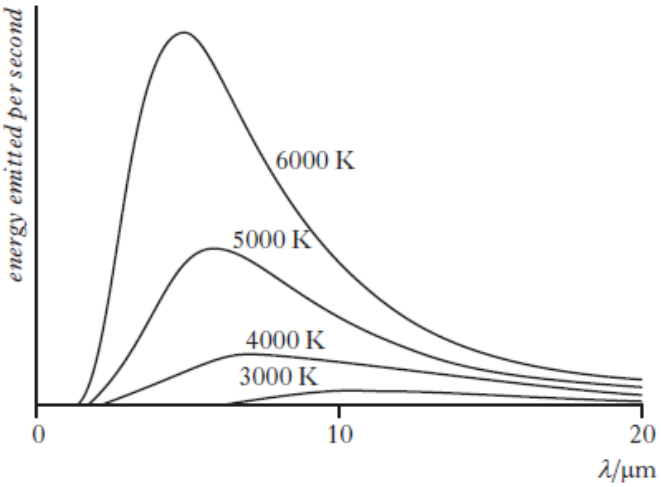
B 277 Hz

C 291 Hz

D 357 Hz

E 361 Hz.

2014 Revised 5. The graph shows how the energy emitted per second from the surface of a hot object varies with the wavelength, λ, of the emitted radiation at different temperatures.



A student makes the following statements based on the information shown in the graph.

I As the temperature of the object increases, the total energy emitted per second decreases.

II As the temperature of the object increases, the peak wavelength of the emitted radiation decreases.

III The frequency of the emitted radiation steadily increases as the emitted energy per second decreases.

Which of the statements is/are correct?

A I only

B II only

C III only

D I and II only

E II and III only

2014 Revised 6. The cooling of the Universe and cosmic microwave background radiation provide evidence for

A the photoelectric effect

B the Bohr model of the atom

C the theory of special relativity

D the Big Bang theory

E Newton's Universal Law of Gravitation.

2014 Revised 7. Astronomers use the following relationship to determine the distance, d, to a star.

$$b = \frac{L}{4\pi d^2}$$

For a particular star the following data is recorded:

apparent brightness, $b = 4{\cdot}4 \times 10^{-10}$ W m^{-2}

luminosity, $L = 6{\cdot}1 \times 10^{30}$ W

Based on this information, the distance to this star is

A $3{\cdot}3 \times 10^{19}$ m

B $1{\cdot}5 \times 10^{21}$ m

C $3{\cdot}7 \times 10^{36}$ m

D $1{\cdot}1 \times 10^{39}$ m

E $3{\cdot}9 \times 10^{39}$ m.

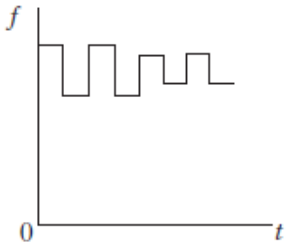
2015 Revised

6. The siren on a police car emits sound which alternates between two different frequencies.

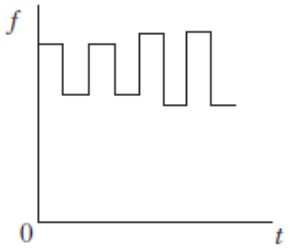
The police car moves at a steady speed as it approaches, passes and moves away from a stationary pedestrian.

Which graph shows how the frequency f of the sound heard by the pedestrian varies with time t?

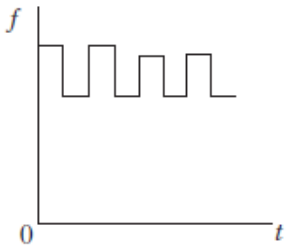
A



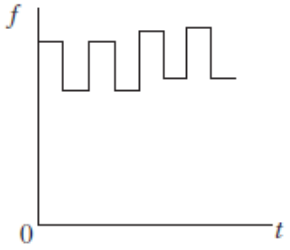
B



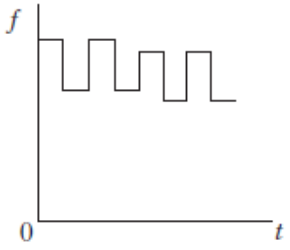
C



D

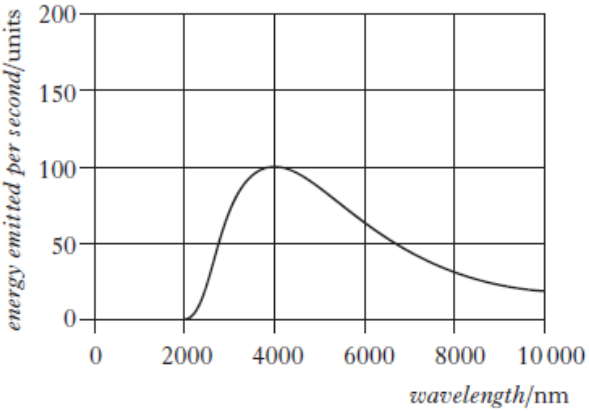


E



2015 Revised

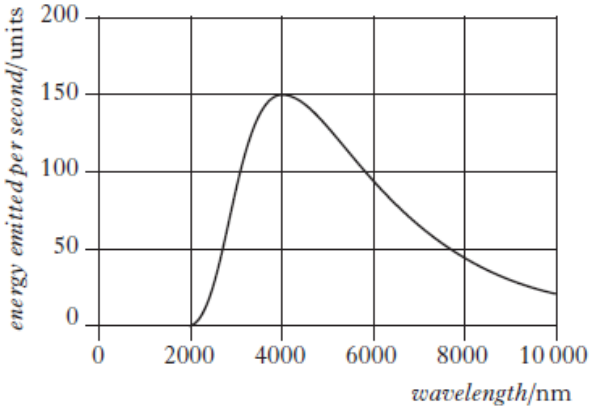
7. The graph shows how the energy emitted per second from an object varies with the wavelength of the radiation emitted by the object.



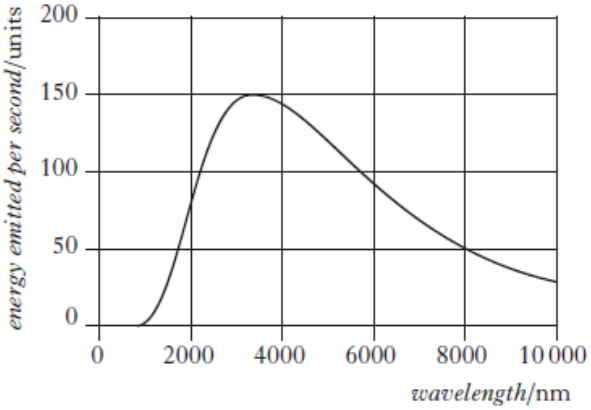
The temperature of the object is increased.

Which graph shows how the energy emitted per second now varies with the wavelength of the radiation?

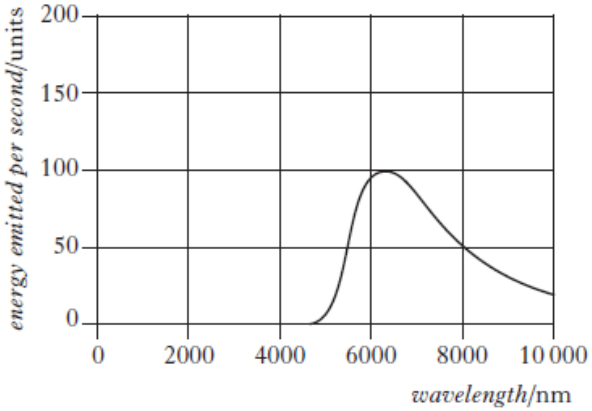
A



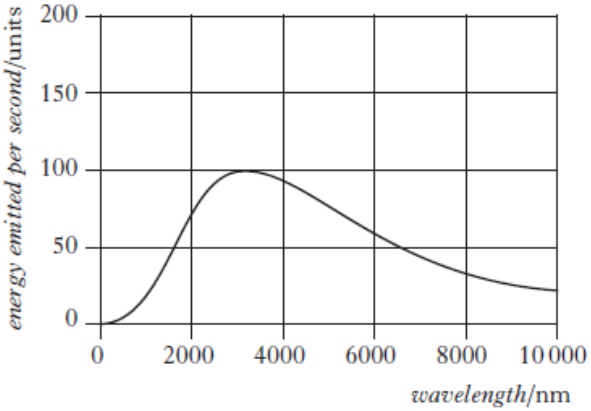
B



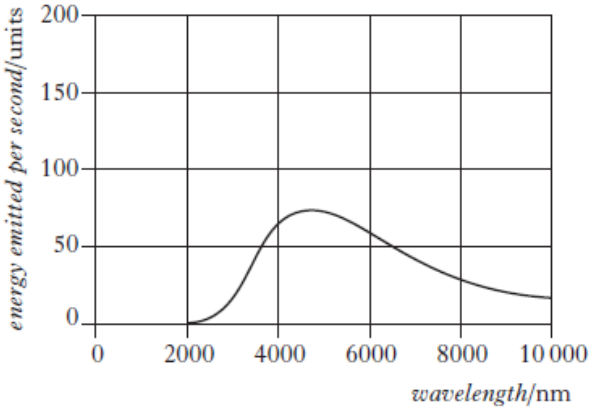
C



D



E



2015 8. A siren on an ambulance emits sound at a constant frequency of 750 Hz.

The ambulance is travelling at a constant speed of 25·0 m s^{-1} towards a stationary observer.

The speed of sound in air is 340 m s^{-1}.

The frequency of the sound heard by the observer is

A 695 Hz

B 699 Hz

C 750 Hz

D 805 Hz

E 810 Hz.

2016 6. A car horn emits a sound with a constant frequency of 405 Hz.

The car is travelling away from a student at 28·0 m s^{-1}.

The speed of sound in air is 335 m s^{-1}.

The frequency of the sound from the horn heard by the student is

A 371 Hz

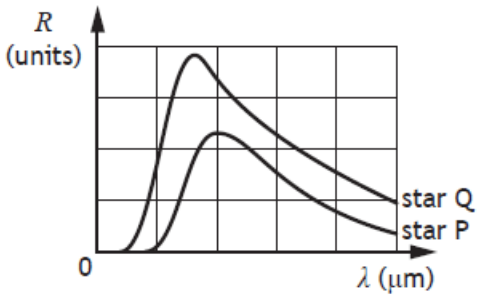
B 374 Hz

C 405 Hz

D 439 Hz

E 442 Hz.

2016 7. The graphs show how the radiation per unit surface area, R, varies with the wavelength, λ, of the emitted radiation for two stars, P and Q.



A student makes the following conclusions based on the information in the graph.

I Star P is hotter than star Q.

II Star P emits more radiation per unit surface area than star Q.

III The peak intensity of the radiation from star Q is at a shorter wavelength than that from star P.

Which of these statements is/are correct?

A I only

B II only

C III only

D I and II only

E II and III only

2017 5. A galaxy has a recessional velocity of $0{\cdot}30c$.

Hubble's Law predicts that the distance between Earth and this galaxy is

A $1{\cdot}3 \times 10^{17}$ m

B $3{\cdot}9 \times 10^{25}$ m

C $1{\cdot}3 \times 10^{26}$ m

D $1{\cdot}4 \times 10^{41}$ m

E $4{\cdot}5 \times 10^{42}$ m.

2017 6. Measurements of the expansion rate of the Universe lead to the conclusion that the rate of expansion is increasing.

Present theory proposes that this is due to

A redshift

B dark matter

C dark energy

D the gravitational force

E cosmic microwave background radiation.

2017 7. A student makes the following statements about the radiation emitted by stellar objects.

I Stellar objects emit radiation over a wide range of frequencies.

II The peak wavelength of radiation is longer for hotter objects than for cooler objects.

III At all frequencies, hotter objects emit more radiation per unit surface area per unit time than cooler objects.

Which of these statements is/are correct?

A I only

B III only

C I and II only

D I and III only

E I, II and III

2019 9. The redshift of a distant galaxy is 0·014.

According to Hubble's law, the distance of the galaxy from Earth is

A $9{\cdot}66 \times 10^{-12}$ m

B $1{\cdot}83 \times 10^{24}$ m

C $1{\cdot}30 \times 10^{26}$ m

D $9{\cdot}32 \times 10^{27}$ m

E $6{\cdot}33 \times 10^{39}$ m.

2019 **10.** A student makes the following statements about the Universe.

I The force due to gravity acts against the expansion of the Universe.

II Measurements show the rate of expansion of the Universe is increasing.

III The mass of a galaxy can be estimated by the orbital speed of the stars within the galaxy.

Which of these statements is/are correct?

A I only

B II only

C III only

D I and II only

E I, II and III